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THESIS

TECHNICAL DATA PACKAGE--A SECOND SOURCING METHODOLOGY

by

Robert Edward Hale

December 1985

Thesis Advisor: David V. Lamm

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T226327

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ITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

EPORT SECURITY CLASSIFICATION	1b. RESTRICTIVE MARKINGS
ECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION / AVAILABILITY OF REPORT
ECLASSIFICATION / DOWNGRADING SCHEDULE	Approved for public release; distribution is unlimited
RFORMING ORGANIZATION REPORT NUMBER(S)	S. MONITORING ORGANIZATION REPORT NUMBER(S)

AME OF PERFORMING ORGANIZATION al Postgraduate School	6b. OFFICE SYMBOL *(If applicable)*	7a. NAME OF MONITORING ORGANIZATION Naval Postgraduate School
DDRESS *(City, State, and ZIP Code)* terey, California 93943-5100		7b. ADDRESS *(City, State, and ZIP Code)* Monterey, California 93943-5100
AME OF FUNDING / SPONSORING RGANIZATION	8b. OFFICE SYMBOL *(If applicable)*	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
DDRESS *(City, State, and ZIP Code)*		10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO	PROJECT NO.	TASK NO	WORK UNIT ACCESSION NO

TLE *(Include Security Classification)*
ECHNICAL DATA PACKAGE--A SECOND SOURCING METHODOLOGY

ERSONAL AUTHOR(S)
ale, Robert E.

TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT *(Year, Month, Day)*	15 PAGE COUNT
ter's Thesis	FROM _____ TO _____	1985 December	138

UPPLEMENTARY NOTATION

COSATI CODES			18. SUBJECT TERMS *(Continue on reverse if necessary and identify by block number)*
IELD	GROUP	SUB-GROUP	Technical Data Package; Second Sourcing (Dual Sourcing)

BSTRACT *(Continue on reverse if necessary and identify by block number)*

The purpose of this research was to analyze the Technical Data Package a second sourcing methodology to create production competition. Two cond sourcing models and two major weapon system programs were presented r this analysis. Issues analyzed include technology transfer, Technical ta Package validation, technical data rights, initial investment costs, d maintenance considerations.

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ISTRIBUTION / AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
NAME OF RESPONSIBLE INDIVIDUAL ofessor David. V. Lamm	22b. TELEPHONE *(Include Area Code)* (408) 646-2775 / 22c. OFFICE SYMBOL Code 54Lt

ORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

#19 - ABSTRACT - (CONTINUED)

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Technical Data Package--A Second Sourcing Methodology

by

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Submitted in partial fulfillment of the
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MASTER OF SCIENCE IN MANAGEMENT

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NAVAL POSTGRADUATE SCHOOL
December 1985

Thesis
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The purpose of this research was to analyze the Technical Data Package as a second sourcing methodology to create production competition. Two second sourcing models and two major weapon system programs were presented for this analysis. Issues analyzed include technology transfer, Technical Data Package validation, technical data rights, initial investment costs, and maintenance considerations.

As a result of this analysis it is concluded that there is no significant guidance for the application of the Technical Data Package second sourcing methodology, there are circumstances that are particularly inappropriate for the use of this methodology, and that the two programs that used this methodology appeared to have met their acquisition goals. This study recommends that one second sourcing model be employed under actual program conditions and that the program manager perform a comprehensive data package validation prior to using this second sourcing methodology.

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LIST OF ABBREVIATIONS

AFALC	Air Force Air Logistics Command
ASPR	Armed Services Procurement Regulation
BFO	Best and Final Offer
CLC	Command Launch Computer
D^3	Detailed Design Disclosure
DCP	Defense Coordinating Paper
DLSIE	Defense Logistics Studies Information Exchange
DOD	Department of Defense
DODD	Department of Defense Directive
DSARC	Defense Systems Acquisition Review Council
F^3	Form, Fit, and Function
FSD	Full Scale Development
FY	Fiscal Year
GD/P	General Dynamics/Pamona Division
IFB	Invitation For Bids
ILS	Integrated Logistics Support
IPS	Integrated Program Summary
JMSNS	Justification for Major System New Start
NAC	Naval Avionics Center
NAVAIR	Naval Air Systems Command
NIF	Naval Industrial Fund
NWC	Naval Weapons Center
OMB	Office of Management and Budget

OPEVAL	Operational Evaluation
PDA	Program Decision Authority
PDM	Program Decision Memorandum
QAR	Quality Assurance Representative
RFP	Request For Proposal
SCP	Systems Concept Paper
SDDM	Secretary of Defense Decision Memorandum
SECDEF	Secretary of Defense
SSA	Source Selection Authority
SSEB	Source Selection Evaluation Board
SSMSM	Second Sourcing Method Selection Model
TDP	Technical Data Package
TECHEVAL	Technical Evaluation

I. INTRODUCTION

Since the advent of OMB Circular A-109, the acquisition of major weapon systems has been focused on the competition of alternative designs and technology to meet the mission needs of DOD. Emphasis has now shifted to the establishment of production competition in order to reduce program costs, improve the quality and reliability of major weapon systems, and increase the industrial base. Several models have been proposed to aid the program office in determining how to develop production competition and which strategy is best suited to obtain this type of competition.

Literature recognizes five methods to create this production competition. These five methods, or second sourcing methodologies or strategies, include Form, Fit, and Function; Technical Data Packages; Leader-Follower; Directed Licensing; and, Contractor Teams. This research effort will focus on the Technical Data Package methdology. This method uses design specifications to obtain an identical (or near identical) item from a second producer or source without any contractor-to-contractor interface.

A. OBJECTIVE OF THE RESEARCH

The objective of this research effort is to analyze Technical Data Packages as a second sourcing methodology and to review several second sourcing models as they relate to

the use of the Technical Data Package second sourcing methodology.

B. RESEARCH QUESTIONS

The primary research question was: What are the primary attributes of the Technical Data Package (TDP) Second Sourcing Methodology and how might this method be successfully employed?

Secondary questions were:

1. What is the Technical Data Package concept?
2. What are the significant factors required for its use?
3. What have been the significant issues or problems involved with using the second sourcing method?
4. How does Technical Data Package relate to other second sourcing methodologies?

C. RESEARCH METHODOLOGY

The research methodology employed included the gathering of information from the literature, and telephonic and personal interview sources. The literature sources included references held at the Naval Postgraduate School, the Defense Logistics Studies Information Exchange (DLSIE), DIALOG, the Air Force Business Research Management Center, the Lessons Learned Programs from the Air Force and the Navy, and DOD directives and instructions. Telephonic and personal interviews were conducted with Navy and Air Force program offices, Systems commands and Logistics commands. Also, a Navy industrial funded activity was included in this research. Persons knowledgeable in systems acquisition, program management,

logistics support and technical data were interviewed. Finally, a private research and consulting firm was contacted for program history and acquisition strategies.

The information gathered above was used to describe and analyze the Technical Data Package itself and the Technical Data Package as a second sourcing methodology. Two second sourcing models and two major weapon system programs served as the basis for this description and analysis.

D. SCOPE AND LIMITATION OF THE STUDY

This research effort will be limited to the analysis of major weapon systems and their components. Aviation electronics will receive particular emphasis.

E. ASSUMPTIONS

It is assumed the reader has a general knowledge of the Major Weapon Systems Acquisition process, program management operations, and general acquisition procedures, concepts, and terminology.

F. ORGANIZATION OF THE STUDY

Chapter II of this study will provide an overview of the Major Weapon Systems Acquisition Process, production competition, and second sourcing methodologies. Chapter III will specifically focus on the Technical Data Package methodology, its relationship with other methodologies, and a review of several models outlining its use. Chapter IV will focus on

Technical Data Packages as used in selected weapon systems. Chapter V will present an analysis of the key issues that must be considered prior to the use of the TDP second sourcing methodology. Chapter VI will provide conclusions and recommendations.

II. FRAMEWORK AND BACKGROUND

A. THE MAJOR WEAPON SYSTEMS ACQUISITION PROCESS

The acquisition of a major weapon system can result from a change in national defense policy, the identification of a mission deficiency, opportunities to reduce Department of Defense (DOD) life cycle costs or opportunities to meet existing mission requirements with new technologies. [Ref. 1:p. 4]

This mission need is documented with a Justification for Major System New Start (JMSNS). The JMSNS is submitted into the Program Objective Memorandum (POM) process. Program approval will be given via the Program Decision Memorandum (PDM). The PDM officially sanctions the major weapon system program, and, when funds become available, gives the authority for the defense agency to initiate the next phase of the acquisition process. In a major weapon system program, there are four phases in the acquisition process. These are Concept Exploration; Demonstration and Validation; Full Scale Development; and Production and Deployment. The last three phases are initiated at a milestone decision point.

The Concept Exploration phase is initiated by a mission need determination as authorized by the Secretary of Defense (SECDEF) in his PDM. The JMSNS provides the required documentation to support the SECDEF's decision. In this phase,

alternative concepts are solicited to meet or exceed the mission need. Also, at this time, the Program Manager (PM) establishes the program charter and the acquisition strategy. The results of this phase are documented in a Systems Concept Paper (SCP) by the defense agency and provided to the Defense Systems Acquisition Review Council (DSARC). Milestone I is the first major decision point in which concept(s) is(are) selected to proceed into the next acquisition phase. The decision will be based on the SCP and the DSARC's recommendation to the SECDEF. Milestone I is a validation of the requirement, based upon such factors as cost, schedule, affordability, readiness, and concept feasibility. The authority to proceed into the next phase is provided by the Secretary of Defense Decision Memorandum (SDDM). [Ref. 2:part 3, p. 25]

The Demonstration and Validation phase is that phase which involves the demonstration of the system concept, estimates the system's suitability to meet the mission need, and help establish a baseline estimate for life cycle costs. The PM will document the results of the Demonstration and Validation phase using the Decision Coordinating Paper/Integrated Program Summary (DCP/ISP). [Ref. 2:part 3, pp. 34-35]

At Milestone II, the DSARC will review the DCP/IPS which outlines the defense agency's management overview of the program and the acquisition planning for the program's life cycle [Ref. 1:p. 8]. Based upon this documentation, the DSARC will make recommendations to the SECDEF as to the most

appropriate system to send into the next acquisition phase. The SECDEF will give his authorization to proceed by issuing a SDDM. Unless otherwise stated by the SECDEF, or if the program doesn't meet thresholds set in Milestone II, this will be the last decision the SECDEF will provide in regards to this particular program. Further approval will normally come from the Program Decision Authority (PDM).

The Full Scale Development (FSD) phase produces a fully designed, tested, and documented prototype of the concept approved in the Demonstration and Validation phase. The FSD phase is divided into three subphases; Engineering, Prototype, and Pilot-Production/Transition to Production [Ref. 2:part 1, p. 15]. During this phase, there is an iterative process of design-test-redesign to perfect a production model design for the following acquisition phase. The results of this phase will be documented in the milestone review documentation and provided to the Program Decision Authority (PDA). [Ref. 2:part 3, pp. 36-47]

At Milestone III, the PDA will authorize initiation of the fourth and final acquisition phase with his service decision memorandum. At times, it may be desirable to approve a limited production run to help in the transition between the prototype model and the production line. If this is the case, the PDA will issue a decision at the Milestone III A decision point. Once this transition is complete, the

approval for full rate production will be given at Milestone III B.

The decision to introduce a second source should be considered prior to this phase and be based on considerations such as the duration of the program and the procurement quantity. [Ref. 2:part 4, pp. 33-34]

B. FEDERAL POLICY IN ACQUISITION

The policy for acquisition can be derived from two sources; the Office of Management and Budget Circular A-109 and the Department of Defense Directive (DODD) 5000.1. The policy stated in A-109 is [Ref. 3:part 3, p. 4]:

1. The needs of the mission will be stated in terms of the mission instead of the equipment. This will promote competition in the creation, exploration, and development of alternative systems and promote innovativeness.

2. Place emphasis on the early stages of the acquisition process allowing competitive exploration of alternative system designs that will meet the mission need.

3. Communicate with Congress early in the major weapon system acquisition process by relating the program to the developing agency's needs.

4. Obtain agency head approval at key decision points in the acquisition process and establish clear lines of authority, responsibility, and accountability for the management of the major weapon system program.

5. Establish a single point for the integration and unification of the system acquisition management process and for the monitoring of policy implementation.

6. Follow guidelines provided in OMB Circular A-76 for private industry utilization.

DODD 5000.1 expanded on these above policies stating that major weapon systems acquisitions shall be carried out

in an effective and efficient manner, that management responsibility will be delegated to the lowest possible level except for those decisions specifically retained by the Secretary of Defense, and that programs designated as other than major shall also comply with the following list of acquisition principles and objectives [Ref. 1:part 2]:

1. Price and design competition shall be obtained for the program to the maximum extent practicable to ensure that mission needs are met in a cost effective and responsive manner.

2. Readiness will be considered on the same level of importance as cost, schedule, and technical parameters and operational sustainability will receive the same management attention as operational effectiveness.

3. Achieve program stability through effective long range planning, evolutionary alternatives instead of state-of-the-art technologies to meet mission requirements, realistic budgeting and cost estimates, plan for economic rates of production, and develop an effective and responsive acquisition strategy plan.

4. Decentralization of program responsibility, accountability, and authority to the lowest management level possible that still maintains a comprehensive view over the entire program.

5. A cost-effective balance must be achieved between system effectiveness, acquisition costs, and major weapon system cost of ownership.

6. To achieve standardization and interoperability of major weapon systems at the international level, cooperation between the U.S. and its allies shall be maintained to the maximum extent feasible.

7. The health of the industrial base and the relationship between Government and industry, both long and short term, shall be a prime consideration in the acquisition process.

C. COMPETITION IN ACQUISITION

Prior to the discussion of competition and its relationship to the major weapon system acquisition process, it is essential for the reader to understand the input market structure in which the Government must operate. With that understanding, the reader can better appreciate why the Government has gone to such lengths to inject its own "competition" into the input market structure.

The input market structure consists of both a demand side and a supply side. In the demand side, the market structure can be broken down into four broad areas: perfect competition, monopsonistic competition, oligopsony, and monopsony. From the point of view of the buyer, a perfectly competitive market is one in which a single buyer cannot influence the market price of the input commodity. A monopsonistic competitive market again has relatively many buyers, however, a single buyer does have some influence over the input item being acquired. The oligopsonistic market narrows the number of buyers even further allowing only a few buyers into the input market structure. Finally, the spectrum is completed with the concept of the monopsony. In this category, there is only one buyer for the goods in the market, thus allowing great influence over the input item price. [Ref. 4:pp. 298-299]

The supply side of the input market is also divided into four categories which closely parallel the demand side's. Perfect competition is described as having many sellers that

accept the price as determined by the market (in other words, the sellers cannot affect the commodity market price as a single entity). The monopolistic competitive market will have relatively many sellers, however, price control is affected by product differentiation. The oligopolistic market is characterized by having a few sellers, one or more of which may influence the market price. This market is also identified as having a mutual interdependence between these sellers. A monopolistic market has only one seller demanding a price up to legal or market constraints. [Ref. 4:pp. 298-299]

With this description as a backdrop, the term "competition" can be better appreciated. Webster defines competition as "n, 4a: the effort of two or more parties to secure custom of a third party by the offer of the most favorable terms" [Ref. 5:p. 464].

As should be apparent at this point, the Government (demand side), as a monopsony, can have a significant impact on the price offered by the sellers (which are usually in something other than a perfectly competitive market). This price influence of the Government is strongest in the earlier phases of the acquisition process when the sellers are vying for the winning concept. The competition here, known as design competition, selects the best technical concept that remains with cost and schedule thresholds. [Ref. 6:part 1, p. 8]

In this highly competitive environment, the sellers have a tendency to provide cost estimates that could be overly

optimistic. The program office, in its role as advocate, often accepts these cost estimates at face value. When technical difficulties arise, the Government most always renegotiates with a sole source, thus losing its monopsonistic leverage. [Ref. 6:part 1, p. 10]

In an effort to reduce the impact of this demand side lack of leverage, the Government attempts to restructure the supply side market by injecting an additional seller, thus taking away the monopolistic advantage of the original seller.

One might ask now if anything less than perfect competition is truly effective. Effective competition can be defined as that competition in which the expected benefits of having competition outweigh the expected costs of creating it [Ref. 7:p. 21]. Also, one must consider in what way the benefits and costs are measured. Monetary and non-monetary considerations must be taken into account. For example, obtaining a lower unit cost is a monetary benefit of competition while the loss of a critical contractor due to competitive pressures is a non-monetary cost [Ref. 7:p. 21].

This thesis is concerned with the establishment of competition during the Full Scale Development or Production and Development phases by altering the supply side market structure. This is where the concept of production competition (second sourcing) is introduced. Production competition involves maintaining two or more sellers or producers of a major

weapon system in continuous competition [Ref. 6:part 1, p. 12]. The objectives here are to improve the industrial base, obtain fair and reasonable prices, and encourage quality and innovativeness [Ref. 6:part 1, p. 11]. Implicit in these goals is the establishment of that supply side market structure that allows at least two producers to affect the market price (oligopoly) instead of one buyer possibly demanding an unreasonable price (monopoly). For clarification, production competition is often used synonymously with price competition. However, this is inappropriate since price is only one of the three objectives of production competition.

1. Benefits of Production Competition

The benefits of production competition are significant albeit unique to each program based on the program's characteristics [Ref. 6:part 1, pp. 16-18]. Frequently cited is the unit cost savings that can result. Empirical studies have well documented this fact [Ref. 8:pp. 25-26].

Further benefits include the improved quality and innovativeness of the systems. Also, better control over cost growth may be provided due to contractors submitting changes for cost reductions vice design changes that add to cost.

Finally, an increase in the number of firms competing (both prime contractors and subcontractors) is an enhancement to the industrial base. This provides for increased

geographic coverage by the defense industry as well as surge and mobilization potential. [Ref. 6:part 1, p. 16]

2. Costs of Production Competition

Production competition may come with a price tag attached. It is obvious that in keeping more than one production line open, the Government will absorb additional non-recurring costs over and above the level expected with one producer (increased administrative costs, tooling and set-up costs, and technology transfer costs to mention just a few) [Ref. 6:part 1, pp. 18-19]. Several reasons that these costs might not be recouped by the use of production competition is the short duration of the program or the limited quantity of items being procured. However, since many systems are procured over a much longer time than originally planned, these reasons have a tendency of not occurring [Ref. 9].

Another problem with the use of production competition is the decrease in contractor capital investment which leads to a weakening of the industrial base (a decrease in profitability may lead to a decrease in capital equipment) [Ref. 6: part 1, p. 18]. Also contributing to this deterioration of the industrial base is that using more than one producer for a system could lead to excess capacity and, therefore, reduced capital investment. This excess capacity could, however, be to the Government's advantage because contractors may take lower prices for their items to reduce their idle capacity [Ref. 10:p. 2].

D. BRIEF HISTORY OF SECOND SOURCING

The first second source established by the Government was after World War I for aircraft carburetors. Stromberg-Carlson, the virtual monopoly on aircraft carburetors at the time, could not be persuaded to develop a floatless carburetor. The Government contracted with Chandler-Groves which, after doubling their engineering budget, developed the pressure carburetor used in all high performance aircraft engines in World War II. [Ref. 11:p. 4]

The Government also would establish a second source when the current industrial base could not fulfill the Government's requirements. A case in point is the B-47 aircraft used during the Korean War. Boeing's production line had to be supplemented with that of Douglas Aircraft Company and Lockheed Aircraft Corporation. Boeing provided the latter two companies with all of the requisite tooling, technical data, expertise, and parts and components. [Ref. 11:p. 4]

It was not until 1968 that second sourcing was defined in the literature as:

> . . . another method for obtaining competition [at] the reprocurement level is 'second source'. . . . Usually the underlying R&D is performed by a single firm. . . . During the initial production or during follow-on production, or both, there is some form of competition. . . .
>
> The new second source sets up a production line. Production by the original and second source may overlap in time, two production lines may be maintained through much of the program, or the original source may drop out of the program, with the award of the contract to the new supplier. [Ref. 11:p. 5]

In the 1970's, it was recognized that second sourcing could be effective in reducing risk in pricing and production

(having an additional source capable of producing an item in case the original source has technical problems in production) [Ref. 11:p. 5]. Thus, second sourcing was initially used to create innovation and increase the industrial mobilization base during war time, and, more recently, used to establish production competition and reduce risk [Ref. 11:p. 5].

E. SECOND SOURCING METHODOLOGIES

Currently, there are five second sourcing methodologies generally recognized in the literature: form, fit, and function; technical data packages; directed licensing; leader-follower; and contractor teams [Ref. 12:p. 13].

Form, fit, and function (F^3) is a second sourcing method by which there is no interaction between production sources nor is there any type of data package that must be provided from the developing source to the second source. The second source is provided only in performance specifications such as overall performance, size, weight, mounting requirements, and interface requirements. This "black box" concept is used mostly for those items which are considered consumable in nature and where the Government is not concerned with the inner workings of the item. This methodology is not considered feasible for maintenance levels other than the contractor level. Increased life cycle costs are generally cited as the reason for not being feasible (increased cost of inventory for spares unique to the particular component,

test equipment, and personnel training costs). Warranties, renewable maintenance contracts, and/or contractor service provision for the life of the component are several ways to make this methodology appropriate for non-organic maintenance philosophies. [Ref. 12:p. 13]

The advantages to F^3 are [Ref. 12:pp. 13-14]:

- Standardization may be achieved at the component level due to the interchangeability of the components produced by the various sources.
- An element of disengagement of Government involvement with the contractor can be experienced.
- The Government does not have to buy or maintain a data package.
- The contractor is responsible for the design of the component.

Disadvantages of the F^3 methodology include [Ref. 12: p. 14]:

- Significant problems may arise if there is performance or interface instability in the design of the system being procured.
- Interface and performance specifications must be explicitly stated to ensure true interchangeability between components.
- Unless there is competitive pressure to ensure reasonable life cycle maintenance costs from the contractor, reapir part costs could become excessive once the contractor realizes he is in a sole source position for items unique to his design.
- For each procurement of the component, the lowest bidder may be the contractor with the least overall appreciation for the required component.
- There will be additional development costs (unless an off-the-shelf model is used) for each procurement due to new costs associated with research and development, engineering, learning curve quantities, and changes.

Technical data packages (TDP's) can be considered the exact opposite of F^3 in the sense that TDP's are based on design specifications as opposed to performance specifications. These methods are similar in that the production sources require no interface. The TDP is normally developed by the original source. The Government then obtains the TDP using either a data rights clause or the purchase of the TDP outright. Problems with outright purchase may be the excessive cost [Ref. 12:p. 14]. Since independent research and development funds were expended by the contractor, this usually means the use of proprietary information in the TDP, therefore an added expense to the Government. Another problem associated with the use of the TDP is the potential ability of a second source to interpret the technical data. This can be overcome by properly validating the technical data package, use of a patent/latent defects clause for technical data, and a preproduction evaluation of the second source. [Ref. 12:p. 14]

Advantages in using the TDP as a second sourcing methodology include [Ref. 12:p. 14]:

- When the TDP is properly validated and proven in production as adequate, it is relatively simple to second source the system/component. In fact, the original producer can be eliminated altogether from future reprocurements.
- The TDP can be used in subsequent procurements to maintain a competitive environment throughout the production of the system/component.

Disadvantages to the TDP methodology are [Ref. 12: p. 14]:

- Obtaining a properly validated TDP for use in reprocurement may be difficult, costly, and time consuming. While the original producer can legitimately use the TDP, a second source may find it difficult to do so.

- The Government must be able to maintain some kind of internal expertise to solve technical problems that may arise.

- The system/component may be too complex technologically to not have some form of interface between the original producer and the second source.

- The second source may be so significantly different technologically from the original producer that use of the TDP as intended may be extremely difficult, if not impossible.

The directed licensing methodology provides for the competition of a system developed by the original source among other contractors. The winning contractor (licensee) is provided the technical data and the necessary technical assistance from the original producer (licensor). The original contractor is compensated by royalty fees in this arrangement. The directed licensing arrangement can be specified by a clause early in the major weapon system acquisition process or negotiated at a later time. Usually, however, it is better to negotiate this arrangement as early as possible, preferably before the selection of the developing contractor (while the Government can still exercise its monopsonistic power). This will help avoid unreasonable royalty fee requirements from the developing contractor. [Ref. 12:p. 15]

Advantages to the directed licensing approach are [Ref. 12:p. 15]:

- The developing contractor is provided protection as to how and in what markets the second source is allowed to

sell the product. Also, the developing contractor is compensated monetarily for each item sold under the licensing arrangement.

- Supply source and production quantity decisions can be delayed until a later time in the acquisition process.

- The Government can disengage somewhat from the acquisition process since it is not required to be involved with the interaction between production sources.

- Potential production competition can be maintained throughout the life of the program.

Disadvantages include [Ref. 12:p. 15]:

- Design accountability may become difficult to maintain.

- Unethical business practices may occur in that some contractors may bid on a project just to gain access to the developing contractor's proprietary data.

- The proper degree of cooperation between the licensee and the licensor may be difficult to achieve especially if there is a lack of genuine support from the developing contractor.

- The cost of royalty fees and technical assistance fees limit the effects of competition or may negate the effects altogether.

The leader-follower second sourcing methodology is defined by the Federal Procurement Regulation (FAR) as:

> . . . an extraordinary acquisition technique that is limited to special circumstances and utilized only when its use is in accordance with agency procedures. A developer or sole producer of a product or system is designated under this acquisition technique to be the leader company, and to furnish assistance and know-how under an approved contract to one or more designated follower companies, so they can become a source of supply. [Ref. 13:part 17, p. 10]

Limitations to this methodology are [Ref. 13:part 17, p. 10]:

- The leader company has the necessary production know-how and is able to furnish required assistance to the follower(s).

- No other source can meet the Government's requirements without the assistance of a leader company.
- The assistance required of the leader company is limited to that which is essential to enable the follower(s) to produce the items.
- It is authorized in accordance with agency procedures.

The FAR also provides several ways in which the procuring contracting officer could implement this procedure [Ref. 13: part 17, p. 10]. First, award a prime contract to the original source and obligate it to subcontract out to a second source and assist the second source as needed in the production of the end items. Second, award a prime contract to the original producer for assistance to the follower company, and award another prime contract to the follower company for the production of the end items. Finally, as a third approach, award a prime contract to the follower company obligating it to subcontract for the assistance with the leader company. [Ref. 13: part 17, p. 10]

Advantages to the leader-follower second sourcing methodology are [Ref. 12:p. 16]:

- This provides a method to transfer all or part of the production of a complex system to a second source.
- Competition can still be used to determine the size of the award split between the two production sources.

The disadvantages to this approach are [Ref. 12:p. 16]:

- The leader company may not be as amenable or enthusiastic to this method because, unlike the licensor of the directed licensing arrangement, the leader does not receive any royalty or assistance fees.
- The leader does not receive the kind of protection provided for under the directed licensing arrangement.

Contractor teams is the last of the five second sourcing methodologies currently recognized. Contractor teams provide for the teaming of two or more contractors in the design of a system. The team with the best design wins the award and each contractor within the winning team is then required to demonstrate the ability to produce a complete system. [Ref. 12:p. 16]

Advantages to this second sourcing methodology are [Ref. 12:p. 16]:

- Qualification of the second source should be essentially eliminated since both sources collaborated on the original design.
- Trade secrets or proprietary data problems associated with technology transfer are not problems since both sources already possess this kind of data.
- There should be more design effort and talent utilized in this approach. As a result, more innovation and a better chance of design success should be expected in the development of the system.

Disadvantages to contractor teams include [Ref. 12:p. 16]:

- The need for a great deal of cooperation and coordination between the contractors of the winning team.
- The cost of the design phase of the proposals may be greater due to the fact that there are two or more design teams involved.

The strategy of "breakout" has also been implied as a second sourcing strategy [Ref. 14:part 5, p. 3]. This should be clarified. "Breakout" is designed to eliminate the "middle-man" when purchasing spares. This does not create a second source even though it is effective in the reduction of unit costs.

F. SUMMARY

This chapter has presented the structure in which the Government purchases its major weapon systems. The Major Weapon System Acquisition process was presented and the marketplace in which it operates was examined. The concepts of price and production competition were distinguished and several second sourcing methodologies to establish production competition were presented.

The next chapter will present the technical data package (TDP) second sourcing methodology in more detail, some of the current issues and problems with its use, lessons learned, and several models describing when the TDP concept is best suited for use in production competition.

III. THE TECHNICAL DATA PACKAGE

A. DEFINITION

The technical data package (TDP) is a technical description of an item adequate for use in procurement. This description assures the adequacy of item performance and defines the design configuration. The technical data package consists of plans, drawings, and associated lists, specifications, standards, models, performance requirements, quality assurance provisions and packaging data and may range from a single line item in a contract to thousands of pages of documentation. [Ref. 15:p. 10]

B. GENERAL

1. Procurement Package

The technical data package must be incorporated into a procurement package prior to an acquisition. The procurement package contains the information required to obtain bids or proposals. The procurement package contains the TDP, administration, legal, and fiscal provisions required for the definitization of a contractual arrangement between the Government and the seller. [Ref. 15:p. 98]

The procurement package is then used in a competitive environment to obtain identical items. MIL-STD 885B defines this type of data as design disclosure data [Ref. 16:pp. 4-5].

MIL-STD 885B also defines three other uses for the procurement package, two of which are concerned with the competitive use of form, fit, and function data for interchangeable parts or for the use in directed procurements. The fourth and final use of the procurement package is in sole source procurements.

2. Importance of the TDP

Since the TDP is the essential document for the procurement of military items, its importance is critical. The TDP's clarity, completeness, adequqcy, and accuracy are prime considerations in determining the method of procurement to be used, the degree of competition obtainable, and the success of the effort to obtain the item with the requisite quality and reliability. [Ref. 18:part 1, p. 14]

A TDP that is incomplete, inconsistent or defective can cause legal, economic, and administrative problems such as [Ref. 18:part 1, p. 4]:

- increased contract price
- substandard supplies to end users
- schedule delays
- disputes
- additional administrative costs
- less than optimum operational or combat effectiveness

3. Uses of the TDP

In addition to the above discussion, TDP's are also important because of the procurement, production, and equipment operational areas. Some of the uses the TDP has are [Ref. 18; part 1, p. 4]:

- as a technical evaluation and analysis tool for the engineer
- as the contracting officer's medium of providing for competition
- as the contractor's basis for submitting bid proposals, make or buy decisions, cost estimating, vendor item purchasing, specialty house procurement, and production engineering
- as the Government quality assurance representative's (QAR) guide for inspection and acceptance
- as the basis for determining maintenance policy and the allocation, the cataloging, and the development of supply support.

The main purpose for the TDP is the manufacture of an item as described in the TDP. The QAR will use the TDP as the basis for the Government's acceptance of the item.

4. Levels of the TDP

There are three levels of the TDP [Ref. 19:pp. 4-5]. These three levels correlate directly with the major weapon system acquisition phases discussed in Chapter II. Level I data are those engineering drawings and associated lists used in the Concept Exploration, Demonstration and Validation, and the Engineering subphase of the Full Scale Development phase. This level of data is used to verify the preliminary design and engineering as well as confirm the technological feasibility of the item. It also provides for a developmental design for hardware, and test or experimentation. [Ref. 19: p. 12]

Level II data is used when the item has progressed to the Full Scale Development and the Production and Deployment

phases. This level supports the ability to manufacture a production prototype and limited production models in final form suitable for field test, deployment, and logistics support. [Ref. 19:pp. 3,12]

Finally, Level III data can also be used in both the Full Scale Development and Production and Deployment phases. It consists of those engineering drawings and associated lists that allow a competent manufacturer to produce and maintain quality control of an item interchangeable with those of the original design without resorting to additional product design effort, data, or recourse to the original design activity. This level of engineering drawings shall provide for:

- end item reflection
- quantity production
- the allowance of competitive procurement of items that will be substantially identical to the original item.

Level III data provides for the highest level of confidence in the reprocurement of items. [Ref. 19:pp. 3,4,12]

C. CONSIDERATIONS AND ISSUES

Prior to further discussion, there are several considerations and issues one must take into account before using the TDP second sourcing methodology. These include the validation of the TDP, the rights in technical data, and some lessons learned in the procurement, maintenance, and use of the TDP as a second sourcing methodology.

1. TDP Validation

The validation of the TDP is recognized to be a controlled process that certifies the acceptability of the competitive acquisition data package. This provides for a lower risk of technology transfer and competitive procurement of hardware from industry. [Ref. 20:part 1]

The use of a properly validated TDP in a competitive procurement provides for lower life cycle costs in that competition should be able to lower the costs of equipment, systems, spares, and repair parts [Ref. 20:part 2]. Also, life cycle costs will be reduced in that items that are identically produced by a second source will stabilize the cost of training, operation, maintenance data, and support equipment. Costs are also reduced because of the elimination of research and development that would be associated with a new design effort. This form of competitive acquisition also increases the industrial base, avoids sole source problems such as "lock ins" and data rights, and provides for stabilized logistics programming. [Ref. 20:part 2]

Government and joint Government-industry TDP validation can also provide for the technical expertise to reside within the Government. This is especially beneficial when it comes time to evaluate and negotiate second source contracts, provide technical assistance to the second source, and better evaluate and negotiate the costs of configuration changes. [Ref. 20: part 2, p. 3]

One must always consider validation of the TDP under the following situations [Ref. 20:part 3, p. 4]:

- when there appears to be requirements for large quantities of the item and multiyear procurements. This will usually necessitate that the producer develop a Level III data package in accordance with DOD-D-1000B. The cost of this package should be overcome by the effects of competition.

- when the item is in the transitional stage between the Government laboratory and the producer. Prototypes and model shops normally are used as the method of developing a workable model of a system. As such, there is usually far less production type documentation available for the producer to use. Validation is used on laboratory-produced data packages in an effort to provide the needed engineering drawings and associated lists for use in volume production.

- when the item is being transitioned to a competitively selected second source from a sole source producer.

When purchasing from a sole source, one is dependent upon the price, quantity, quality and delivery schedule of the sole source. The goal is to utilize a broader segment of the industrial base on a fixed price, competitive basis while ensuring consistent reliability and the interchangeability of the items procured. However, there are problems associated with this transition. First, the original producer sees the use of a second source as a threat to his current position and the future follow-on business of spare parts sales. Consequently, he has no real incentive to provide a complete and accurate TDP. Second, as a carryover from the first problem, the original producer will incorporate proprietary parts, processes, and specifications, and not provide sufficient detail in the TDP to allow for a second source to produce the

item. Finally, as a result of the above two problems, the TDP will not be sufficient to produce an identical item. The use of a performance specification would then be required to work around the deficient area(s) in the TDP. This approach presents its own problems including [Ref. 20:part 3, p. 5]:

- the cost of new supplier providing the missing parts of the TDP and the possibility of having to contend with his proprietary data
- the cost of testing and qualifying the design and its attendant delays in delivery
- the additional cost of inventory required to support not only the item of the original producer but also the item of the new supplier

Appendix A provides a basic guideline to determine whether or not validation is appropriate for a particular TDP. This is not designed to be all inclusive [Ref. 20:part 6].

At the Naval Avionics Center, Indianapolis, Indiana, there are five methods of technical data package validation recognized and used [Ref. 20:pp. 9-10]. Method 1 is a desk top drawing audit that assures the data package is in accordance with MIL standards and is complete. This method does not assure that the item detailed wlll be producible or will function as required. Use of this method should be limited to simple, unsophisticated, and low risk items.

Method 2 is a desk top drawing audit that also includes a configuration audit review of the items produced to determine the degree of conformance of these items to the data package. Due to the small sample of items taken, this method does not usually provide assurance that the technical data represent

the item nor does it provide for any insight into the processes used by the original source to produce the item.

Method 3 is a desk top drawing audit and a configuration audit review followed by a real time audit of the contractor. This audit consists of a random selection and test of the contractor's make and buy parts, measuring them against the technical data, and assembling the parts and testing them against the function specifications. This audit also includes an onsite survey of such things as manufacturing processes, documentation, and facilities.

Method 4 is a desk top drawing audit followed by the actual manufacture and test of a realistic number of items using the provided TDP. This method provides for the highest assurance (lowest risk) that the TDP provided to the second source is producible.

Method 5 is a combination of Methods 3 and 4. Low risk items are validated using Method 3 where as the high risk items use the costlier Method 4 for validation.

The validation process is used to accomplish the following [Ref. 20:p. 11]:

- assure the TDP is complete and accurate to allow for item replication
- assure that the TDP will provide the required manufacturing processes for use by the second source
- assure that the design will provide sufficient quantities during production to meet military cost constraints and quantity requirements
- assure that item testing is defined and that specifications allow for mass production

- assure that the TDP possesses the requisite detail to allow for procurement of parts and material from multiple suppliers in a timely and cost-effective manner

Appendix B gives a comparison of the five validation methods [Ref. 20:pp. 13-15].

2. The Rights in Technical Data

No discussion of the technical data package would be complete without mentioning data rights. It is not the intent of this thesis to provide an in-depth analysis of this issue, however, this researcher feels that it is important that the reader have an appreciation of this issue when considering the use of the TDP as a second sourcing methodology.

Historically, the data rights issue started in the 1950's. The 1955 Armed Forces Procurement Regulation (ASPR) data rights clause afforded no protection for the contractor's privately developed data [Ref. 21:p. 2]. The clause simply allowed the Government to disclose any data provided for any Government purpose. In 1957, responding to the concerns of industry, the DOD updated the data rights clause that provided for limited and unlimited rights in technical data. Unlimited rights gave the Government the right to disclose data in any manner or form it saw fit. Limited rights require the Government to gain permission of the contractor prior to the use of this data for manufacturing or procurement of spares. [Ref. 21:p. 2]

Still dissatisfied, industry sought further changes the following year. The 1958 clause allowed contractors to

exempt from the data package information pertaining to commercial items or items developed at private expense [Ref. 21:p. 3]. This clause defined proprietary data as the contractor's secrets of manufacture that could not be discerned from product inspection and which were protected by the contract from unrestricted use by others. This protection was afforded to prime as well as subcontractors. As a result of this clause, there were many disputes over the number of "holes" in the technical data (then known as the "swiss cheese" effect). Consequently, in 1964, the data rights clause was revised into what is the basis of today's policy. The clause still distinguished between limited and unlimited rights, however, it dropped the proprietary data concept. In place of that, the clause introduced the concepts of "unpublished" and "developed at private expense" as tests of limited rights. This was the first time a clause definitized the conditions under which the Government had unlimited rights and the contractor could limit Government use and disclosure. This clause generally required the contractor to furnish all data and identify which data had limited rights. This precludes the "holes" in the data package discussed above. [Ref. 21:pp. 3-4]

OMB Circular A-109 has innovation and competition as two primary goals in defense acquisitions. Implied in the above historical perspective is that balance between achieving unlimited rights for competition while ensuring innovation

in industry by the protection of its data. It is precisely this balance that makes data rights an issue when using TDP as a second sourcing methodology.

Other concerns in the limited rights area includes [Ref. 20:p. 7]:

- Government-owned TDP's must be free of limited rights to ensure true competition from multiple sources
- items that are sole source may be produced by companies with limited production capacity, possibly constricting the requirements of the Government
- sole source contractors can set their own cost and schedule factors without regard to unit prices or delivery
- limited rights must be identified early and justified to minimize or eliminate their effects in the competitive acquisition process

The most effective way to resolve any technical data rights problem is to plan early in the acquisition the identification, negotiation, and/or predetermination of limited rights. This process also includes challenging any limited data rights not fully justified or suspect for other reasons. [Refs. 22,23]

It should be noted that predetermination of rights in technical data can be a lengthy process involving extended periods of time. To ensure valid limited data rights, the contractor must have time to gather evidence in support of his position. This could cause contract award delays. Also, in order for the Government to acquire the unlimited rights in limited data, it must be shown in writing that [Ref. 24: p. 89]:

- there is a clear need for the reprocurement of the item, component, or process to which the technical data relates
- no acceptable substitute is available
- the data in question is sufficient to permit a competent party to manufacture the items or components in question or to perform a process without the need for additional data not obtainable at a reasonable cost
- the anticipated net savings in reprocurements will exceed the cost of the technical data and the associated rights

Several alternatives to the above process of predetermination may help cut some of the time off an already lengthy acquisition process. First, the Government could place in the Request for Proposals (RFP) an option for the acquisition of unlimited rights in limited rights data. The time factor is reduced because the Government does not challenge the contractor's claim to limited rights or exercise the option to acquire the rights until the need for it arises. [Ref. 24: p. 90]

A second approach, similar to the first but for non-negotiated contracts, requires the contractor to price out the unlimited rights in limited rights data as a separate line item in the Invitation for Bids (IFB) instead of a priced out option in the RFP above. This approach allows for the Government to compare the costs of unlimited rights for limited rights data between the bidders. Also, competitive pressures usually dictate more reasonable prices of these rights. [Ref. 24:p. 90]

If the Government finds itself in a strong negotiating position, it could use a clause requiring the unlimited

rights of limited rights data submitted under the contract as long as the Government procures a minimum amount of the item from the contractor. Also, a "non-use" agreement would be used to a second source, which allows the data to be used only on that second source contract. [Ref. 24:p. 91]

As a final approach to cut down the time factor dictated by the predetermination process, is the acquisition of a licensing agreement from the original contractor. Thus, a special clause in the RFP for the pricing out of a license allows the Government to deliver limited rights data to other supply sources as the Government sees fit. [Ref. 24:p. 91]

The Government finds itself at a disadvantage if there is no competitive pressure on the contractor to reasonably price out his limited rights. This is why early planning is emphasized. However, when this cannot be accomplished (i.e., break out of spare parts), the Government must ensure the validity of any limited rights data claims. Challenging the contractor is about the only approach available. In those cases where valid limited rights data arise, several alternatives exist to mitigate their impact. First, for those items not equipment essential, then alternate sources for similar items may be feasiable [Ref. 20:p. 7]. Another approach would be to reverse engineer the item in question to determine its performance parameters [Ref. 20:p. 7]. Another source could then be developed to make the items to meet those parameters [Ref. 20:p. 7]. It should be noted that case law prohibits

the obtaining of competition by using reverse engineering from drawings with proprietary data (Comp. Gen. Dec. B-153941, Aug. 27, 1964, Unpub.).

Advantages to obtaining data rights include the ability to create a second source in out-year procurements. Also, the dependency on a sole source is lessened. Disadvantages of data rights include cost. Even if the contractor agrees to unlimited rights in the contract, the cost can be substantial to acquire and maintain it. One contractor interviewed estimated the Level III data package added another 50% to the base contract [Ref. 25]. Also, a more insidious disadvantage is the false sense of security a data package can provide. Even when validated by an independent organization, the second source may still not be able to perform to the data package due to unincorporated technical data changes, lack of experience, or references to proprietary materials or processes [Ref. 20: part 5, p. 19].

3. Lessons Learned

In a study done of 100 actual procurement actions [Ref. 26], there were five main categories of deficiencies discovered: accuracy, adequacy, currency, completeness, and clarity. These are defined as follows [Ref. 18:part 1, p. 13]:

- Accuracy: freedom from mistake or error, correctness
- Adequacy: the documentation will be evaluated in terms of the purpose and design of the system or equipment being developed or produced and also in relation to standard engineering and design practices, or, if the item was delivered within the acceptable time, dollar,

and performance boundaries, then it can be said the TDP was adequate.

- Currency: the contractor's quality program will assure that obsolete drawings and other out-of-date material are removed from all points of issue and that only current documentation is delivered to the service.

- Completeness: the documentation will, under the contractor's quality assurance procedures, be reviewed to ascertain that it provides all the information needed for the purpose intended,

- Clarity: there are four subsets to this discrepancy

  clarity--the quality or state of being clear: lucidity

  legibility--capable of being read or deciphered

  conciseness--marked by brevity of expression or statement

  definitive--serving to provide a final solution: conclusive, authoritative, and apparently exhaustive; serving to define or specify precisely

D. CURRENT MODELS AND THEIR CHARACTERISTICS

The intent of this section is to provide the reader with a brief description of several models discovered during this research effort. The first model, known as the Second Sourcing Method Selection Model (SSMSM), was developed as the result of a Master's Thesis at the Naval Postgraduate School in 1979. The other model has been developed more recently by a Naval Air Systems Command industrial fund activity, the Naval Avionics Center (NAC) in Indianapolis, Indiana. This model is entitled the F^3/D^3 Acquisition Decision Process (F^3--form, fit, and function; D^3--detailed design disclosure).

1. Second Sourcing Method Selection Model (SSMSM)

The SSMSM model is a heuristic model using a matrix format. It consists of 14 decision variables that help evaluate which of five second sourcing methodologies (form, fit, and function; technical data package; leader-follower; directed licensing; or contractor teams) would prove most effective. At best, the model will present one method that is clearly superior. At worst, the model may eliminate only one or two of the methods. The model is currently being evaluated for preliminary use. [Ref. 12:p. 18]

The model is actually made up of two matrices, one for the pre-production phase and the other for the post-production phase. The former is designed to help the program manager develop his acquisition strategy as it relates to competition. Ideally, this decision will be made before the Full Scale Development phase, the DSARC II decision point. The post-production model is for use by those programs that are already in the Production and Deployment phase. The distinction is made between the pre- and post-production phases because the effectiveness of each of the decision variables may be changed [Ref. 12:p. 18]. Indeed, it has been shown in one cost model that the timing of developing a second source can be especially crucial if the goal of the second sourcing strategy is to cut program costs as well as its more traditional goal of increasing the industrial base [Ref. 27:p. 20]

Presented below will be a brief summary of the 14 decision variables. The entire model can be found in Appendix C. At the end of this presentation, a general analysis of the model and a more specific discussion of the decision variables as they relate to the TDP second sourcing methodology will be presented.

The decision variables include the following items [Ref. 12:pp. 16-18].

a. Quantity to be Procured

The quantity to be procured will have an effect on the program's adaptability to second sourcing. Usually, the more items procured, the greater the benefit of competition if cost savings are desired. Conversely, the smaller the quantity, the benefits of competition using second sourcing will not be as great and, in fact, program cost may increase. In this case the goal of second sourcing may only be that of increasing the industrial base.

b. Duration of Production

The longer the duration of production, the more practical second sourcing becomes. If it takes time to develop a second source (i.e., two years), then a program with planned procurements for only four years may not reap the benefits of competition.

c. Slope of the Learning Curve

If the production learning curve is relatively flat, then a second sourcing may be feasible in that the original

producer may not be too far down the learning curve. This allows the second source to produce an item almost as efficient as the original source. However, a learning curve that has a steep slope may put the potential second source at too great a disadvantage relative to the original source. This is true because of the efficiency and experience gained by the original source.

d. Complexity of the System

As the system becomes more complex, interaction between the sources of production becomes more essential.

e. Other Potential Government and Commercial Applications

Items with wide commercial or Government application will most likely be protected with trade secrets or proprietary data claims of the contractor. On the other hand, potential second sources will be interested in items of this sort.

f. Degree of Privately Funded R&D

The more a contractor spends on private research and development, the more reluctant he will be to provide the design to a second source, especially if there are no restrictions to the use of the design.

g. Cost of Unique Tooling/Facilities

As the cost for special tooling, special facilities, as well as other non-recurring and start-up costs increase, the less likely a second source will be able to supply in a cost-effective manner. The full amortization of these

costs will be difficult to achieve over the duration of the program.

h. Cost of Transferring Unique Government-Owned Tooling/Equipment

If it is too expensive or difficult to transfer unique Government-owned tooling or equipment to a second source, it may be necessary to provide a duplicate set of tools or equipment to the second source. As this cost increases, it can work against the adaptability of a program for second sourcing.

i. Contractor Capacity

Insufficient capacity of the original source may require the establishment of a second source to ensure delivery schedules are met. If, on the other hand, the original contractor has sufficient or excess capacity, the cost of establishing a second source may be excessive because of the additional overhead burden placed on the units procured.

j. Maintenance Concept to be Employed

Maintenance considerations will have a significant impact on whether or not to use second sourcing. If items procured are interchangeable, but not identical, it becomes increasingly difficult and costly to support these items with field-level repair parts and maintenance personnel.

k. Production Lead Time

It will become increasingly difficult to justify the use of second sourcing as the production lead time increases relative to the program life expectancy.

l. Amount and Type of Subcontracting

With a small base of qualified subcontractors to depend upon, the effects of competition and second sourcing are limited.

m. Contractual Complexity

Contractual arrangements such as warranty agreements, design-to-cost considerations, and life cycle cost parameters greatly increase the complexity of the contract and can inhibit the second sourcing process.

2. Detailed Analysis of the SSMSM Model

There are several comments about the model this researcher would make. First, the inclusion of some decision variables provide the user with no means of ranking the five second sourcing methods. Specifically, decision variables such as contractual (contractor) complexity, production lead time, contractor capacity, and Government tool transfer cost are all given equal ranking. Therefore, while it may determine if a program is suitable for competition, it does nothing for evaluating which of the methods is best suited for second sourcing. This leads into another observation which this researcher finds as an omission on the part of the model. There should be some kind of analysis of the program and its acquisition strategy prior to the choosing of a second sourcing methodology to ensure the program is ready for competition. Issues such as validation of the data packages, data rights, and market analysis should be resolved. These issues, as well

as the decision variables of state of the art, technical complexity, and degree of private R&D, have a significant influence on the method chosen.

In the analysis of the specific decision variables, there are several problems in the ranking of the TDP methodology. The technical complexity decision variable ranks TDP as being undesirable. This is not necessarily true. The TDP is well suited to the second sourcing of complex items if the TDP has been properly validated. Examples of this include the Navy's AN/AYK-14 standard airborn computer and the HARM command launch computer. [Ref. 28:p. 3]

Technical state of the art also suggests that TDP is inappropriate. The fact is, it is highly desirable to use a validated TDP to address technological and producibility concerns in order to transfer technology to a second source. [Ref. 29:p. 12]

The degree of private R&D suggests that TDP is inappropriate. However, if the issue of data rights is approached early and directly and, using techniques discussed earlier to minimize the impact of valid data rights, then the TDP approach may be appropriate.

Complex maintenance requirements does not address the three levels of maintenance used by the Navy nor does it discuss the items procured that are identical in nature. A TDP is highly desirable for any maintenance actions done organically.

Finally, the model states that if there is heavy subcontracting, then the TDP is not well suited as a second sourcing methodology. On the contrary, with a properly validated TDP, more sources will have a chance to compete and be certified as a second source producer.

The presentation of the SSMSM Model was provided to allow the reader the opportunity to examine the decision variables used in choosing among the second sourcing methodologies. Next, the Naval Avionics Center's F^3/D^3 Acquisition Decision Model is presented as an alternative to the SSMSM Model.

3. Form, Fit, and Function/Detailed Design Disclosure (F^3/D^3) Acquisition Decision Model

This model is more deterministic in nature in that it uses a flowchart with sequential questions to arrive at an acquisition approach (using the Acquisition Approach Decision Model) and then a competitive acquisition strategy (using the Acquisition Strategy Decision Model). The term approach is defined as the method the Government plans to use to specify the system or component being acquired. Strategy is a term that represents the Government's plan for ensuring that more than one producer is ready, willing, and qualified to respond to a Government solicitation for a specific system or equipment.

The F^3/D^3 Acquisition Decision Model is broken down into four stages: develop optimum competitive program strategy; tailor an acquisition approach; tailor a competitive F^3 (form,

fit, and function) or D^3 (detailed design disclosure) strategy; and application guidelines. Each of these stages will be discussed briefly, including the questions or attributes each stage uses in its decision process. The complete model is provided in Appendix D for review by the reader.

a. Stage One

Developing a competitive environment is a stage that requires the program manager to make those decisions early in the acquisition process that will foster a competitive environment and help avoid situations that may limit his program to a sole source. This first stage has four sections that are briefly described below.

(1) Review Program Status Prior to FSD. This section addresses several questions or issues that the program manager must complete prior to continuing the production competition process. These requirements include [Ref. 30:part 4, p. 1]:

- all major design tasks have been identified and a plan prepared to resolve them
- firm and realistic performance, cost, and schedule goals are established
- Preliminary Maintenance Concept complete
- Test and evaluation plan complete
- funding requirements by fiscal year approved and budgeted
- limited production or pilot production requirements determined
- acquisition plan complete
- practical "fall-back" options and alternatives identified

(2) Establish Product Baseline. If DSARC II gives the approval to continue into the FSD phase, then the following considerations should be reviewed to complete the product baseline [Ref. 30:part 4, p. 2]:

- complete the engineering development and testing of the equipment
- producing a limited number of units for test and evaluation
- implementing a Configuration Management Plan
- preparing an Integrated Logistics Support plan (ILS)
- updating the Test and Evaluation Master plan (TEMP)
- conducting TECHEVAL and OPEVAL
- obtaining Approval for Production
- ensuring competitive sources for production units

(3) Competitive Readiness Review. A series of questions are presented to the program manager to identify any program weaknesses that may influence the success or failure of the program. Below is a list of these questions [Ref. 30: part 4, pp. 2-7]:

- Market Research. Has market research identified sufficient industry interest to establish competition?
- Technical Availability. Is the technology planned for the equipment design available as an accepted industry production process?
- Stability of Performance Requirements. Are the performance requirements expected to remain stable after initial production?
- Budgeting for Competition. Is sufficient "front end" funding available to establish competition?
- Time/Schedule Constraints. Is there sufficient time in the schedule to establish production competition to realize a return-on-investment?

- Character of Support Resources. Is there adequate technical support and funding available to implement production competition?

- Return-on-Investment. Is a return-on-investment anticipated?

(4) Production Readiness Decision. If, based on the above considerations, the program manager feels that the program is ready for production competition, then he should proceed to the next stages. If not, he must resolve those considerations prior to continuing. For those mature programs already in the Production and Deployment phase, special considerations must be taken into account in order to achieve and maintain competition.

b. Stage Two

The next stage of the model, selecting an acquisition approach using the Acquisition Approach Decision Model, defines and compares the F^3 and D^3 acquisition approaches. This stage is based on the following assumptions [Ref. 30: part 5, p. 3]:

- the decision to use production competition will be made before proceeding into FSD

- there will be adequate "front end" funds available for proper program implementation

- D^3 equipment configuration control will be maintained by the Government

- the maintenance concept will be established before proceeding into the next section of this stage

The final section of this stage applies a decision process to determine which acquisition approach to use, F^3 or

D^3. This Acquisition Approach Decision Model is a flowchart (Appendix C) that asks a series of questions. Anytime an answer to a question directs the user to the bottom of the flowchart, the optimum acquisition approach has been indicated. The questions are as follows [Ref. 30:part 5, pp. 3-8]:

- Maintenance Concept (level-of-repair).

  What is the target maintenance concept for the equipment?

  Is the intermediate level maintenance afloat?

- Commercial Developments.

  Are there at least two sources of off-the-shelf or modified commercial equipment available that must meet the system requirement?

  Can lifetime supportability/availability of the equipment be assured?

- Funding.

  Are sufficient funds available to qualify two or more sources?

- Performance Specifications.

  Can a comprehensive performance specification be developed to the Weapon Replacement Assembly level with a high degree of confidence?

c. Stage Three

Selecting an acquisition strategy is the third stage of this model. This is done by using the Acquisition Strategy Decision Model (Appendix D). This model associates the acquisition approach (F^3 or D^3) chosen in the previous stage to the acquisition strategy. If the F^3 acquisition approach is pursued, the strategy model identifies two variations to acquire performance specification: industry-sponsored developments or Government-sponsored developments. If the D^3 acquisition approach is pursued, there are six acquisition strategies that can be

used to ensure transfer of technology to a second source. These six strategies are divided into two categories: industry-led responsibility or Government-led responsibility. Industry-led strategies include contractor teaming, directed licensing, and leader-follow. The Government-led strategies include performance specification/model/available data, independently validated data package, and joint industry-Government validated data package.

Except for the distinction of industry or Government sponsored development, the F^3 acquisition strategy is basically the same as that described in Chapter II (which, incidentally, is based on the SSMSM Model). The same can be said for the D^3 acquisition strategies of contractor teaming, directed licensing, and leader-follower. Therefore, these will not be reexamined.

The TDP second sourcing methodology described in Chapter II (based on the SSMSM Model) has been divided into three acquisition strategies under the F^3/D^3 Acquisition Decision Model. These are the three Government-led acquisition strategies listed several paragraphs above. The basic intent of these strategies is to transfer technology without any contractor-to-contractor interface. The first of these three acquisition strategies, performance specification/model/ available data, uses a performance specification along with the most recent model of the item and all uncertified data available to produce the item. The level of duplication of

the item will be consistent with the maintenance philosophy planned. This strategy gives the advantage of early introduction of production competition and is conceptually simple to apply. Disadvantages include potentially significant contractor lead time to develop production capability, substantial Government involvement to resolve conflicts and issues, performance/cost/schedule risks proportionate to technical complexity of the item, and requires a stable design. Variations to this strategy are the use of Level I or II data, Level III data (possibly verified independently) and warranted data from the developer. [Ref. 30:part 6, pp. 5-6]

The second Government-led acquisition strategy is the independently validated data package [Ref. 30:part 6, p. 6]. It makes use of the performance specification, the most recent model of the item, and a Government validated data package. All rights to data are procured and a Level III data package is validated. Special emphasis is placed on documenting any configuration changes. This strategy reduces the risk of technology transfer, weakens the developer's leverage over the Government during competition, Government agencies develop in-house knowledge of the item, competition efforts are greatly enhanced, and limited rights in data issues are resolved. Disadvantages [Ref. 30:part 6, p. 7] include the erosion of benefits generated by competition due to the cost of validation and the longer period of time to achieve production competition, extensive efforts and facilities are required of the Government

to perform the data package validation, and the Government is responsible for data package defects. Variations on this strategy would be to what level (or which method) the validation process would be performed and whether or not to use a contractor as an independent source of validation.

The third Government led acquisition strategy is the joint Government-industry validated data package [Ref. 30: part 6, p. 8]. This strategy also uses the performance specification, the most recent model of the item, and available data. However, this is provided to both the potential source and the Government validation team. The Government procures all data and data rights, the Government and the contractor concurrently perform validation and development of a Level III data package. This strategy provides all of the same advantages as the previous strategy as well as providing the lowest possible technical risk in achieving technology transfer, reduces Government risk of data package defects, fosters the second source process to develop naturally and introduces the threat of production competition early on in the acquisition process [Ref. 30:part 6, p. 8]. Disadvantages of this acquisition strategy are basically the same as the above independently validated data package strategy [Ref. 30:part 6, p. 8].

The Acquisition Strategy Decision Model has a strategy flowchart for each of the acquisition approaches developed in the second stage. The F^3 part of this model uses the following decision criteria to determine industry or Government sponsored development programs [Ref. 30:part 6, pp. 9-11]:

- Is commercial off-the-shelf or moderately modified equipment available?
- Are there at least two sources, or can two sources be developed for the commercially available equipment?
- Is time delay compatible with Government requirements?

The D^3 model uses the following decision criteria to determine which of the six acquisition strategies should be used [Ref. 30:part 6, pp. 11-15]:

- Will the equipment use a technology or production technique that is very difficult to apply or transfer?
- Will the complexity require the design/development capabilities of two or more contractors?
- Would any contractor claim sole proprietary ownership of techniques, processes or designs?
- Will the direct assistance and know-how of the developing company be required to transfer the technology to another source and can the developer be motivated to provide the assistance within reasonable financial limits?
- Will the equipment design be reasonably simple, stable and use a mature technology and will a reasonable data package be available?
- Could an independent and objective validation of the developer's data package be performed and is the actual introduction of competition time critical?

d. Stage Four

The actual application guidelines of the above acquisition strategies are considered the fourth and final stage of the F^3/D^3 Acquisition Decision Process. The reader is directed to Appendix D for a complete description of those guidelines.

4. Detailed Analysis of the F^3/D^3 Acquisition Decision Process

The model itself is very comprehensive, touching on many more issues than this researcher uncovered during program office interviews. One strength is the model's notion of acquisition (or data) approach as an independent decision process, closely related to, but separate from, the acquisition strategies.

Another strong point of this model is the series of steps used to ensure a program is ready for competition. Also, the logical flow of the entire model aids the program manager to better organize his activities, prepare for upcoming issues, and avoid any problems that could trap him into a sole source procurement.

Finally, the model in general seems to have an appreciation for the fact that the acquisition strategy or plan is a constantly evolving, "living" document. Program and item characteristics may always change as the program moves forward in the major weapon system acquisition process.

The addition of a post-production model or set of decision criteria would make this model even more useful. Those programs past the FSD phase may still benefit from competition. This is true because many programs that were initially planned to run only a few years, often continue in production for many more [Ref. 9].

As this model relates to the TDP second sourcing methodology described in Chapter II, one can clearly see that

this method is broken down into three acquisition strategies; performance specification/model/available data, independently validated data package, and joint industry-Government validated data package. Combined, these three strategies present the significant variations and issues to be considered in using the TDP second sourcing methodology.

5. Comparison of the SSMSM Model and the F^3/D^3 Acquisition Decision Model

The SSMSM Model does well in presenting major economic, technological, and programmatic factors to the program manager. It is also a beneficial model in that it relates these factors to both the pre-production and post-production phases of a program.

The F^3/D^3 Acquisition Decision Model, as stated earlier, is a much more comprehensive framework. It does well in guiding the program manager in a logical, sequential process that ensures a program is first ready for competition, and then identifies the proper acquisition approach and strategy. This is one big advantage over the SSMSM Model. The F^3/D^3 Acquisition Decision Model also points out a new classification scheme that distinguishes the acquisition approach (F^3 or D^3) as independent of the fact that competition may or may not be used. This model should be extended to cover more mature programs already in the post-production phase.

E. SUMMARY

This chapter defined the TDP, why it is important in the acquisition process, and several key issues that should be

identified and resolved prior to its use as a production competition second sourcing methodology. Also, this chapter briefly presented several second sourcing models and their respective decision variables and attributes. The next chapter analyzes several programs that have used the TDP second sourcing methodology.

IV. PROGRAM ANALYSIS

A. INTRODUCTION

The intent of this section is to present two programs that have used the Technical Data Package (TDP) second sourcing methodology. This will provide the reader with actual applications of the TDP second sourcing methodology. During these presentations, the various issues and decision variables discussed in Chapter III will be identified.

B. THE SPARROW MISSILE PROGRAM

1. Introduction

This presentation will be based upon program office interviews, analysis of program acquisition plans, and a research project and report performed by the BDM Corporation under several Joint Cruise Missiles Project Office contracts. The latter source of information is especially useful for it provides a long term perspective over the entire second sourcing effort of the AIM-7F SPARROW missile.

2. History

The program office for the SPARROW missile (generic name for all versions of this missile) was established in 1951. This all-weather tactical missile was assigned then to the Navy's F-3B interceptor in 1955 and the F-4B interceptor in 1956. [Ref. 31:p. 4]

All of the development and production effort for the SPARROW missile had been accomplished by the Raytheon Company. Under production since 1958, the missile has undergone several major improvements [Ref. 31:p. 4]. Each of these improvements increased the operational envelope of the missile. However, due to the vacuum design, the missile experienced low operational availability. The upgrade from the AIM-7E-2 to the AIM-7F was to incorporate new solid state electronics in an effort to improve this operational availability. The use of smaller electronics also provided for the use of a larger warhead and boost-sustain motor. [Ref. 32:p. 3]

The AIM-7F upgrade efforts took considerably more time than was originally estimated, extending over a period of eight years. It was near the end of this development effort (1971) that the Navy decided to second source the program. Appendix E gives a time line of the development history of the AIM-7F SPARROW missile [Ref. 32:p. 4].

3. Missile and Documentation Characteristics

The second sourcing effort of the AIM-7F SPARROW missile will be limited to the guidance and control (G&C) assembly. Appendix F illustrates the principal elements of the G&C assembly (shaded) which represents almost 90% of the total missile cost [Ref. 32:p. 5]. The SPARROW missile is designed to be used on the F-4, F-14, and the F-15 aircraft. It is an all-weather, radar guided, semi-active, air-to-air/ship-to-air missile used by the Air Force and the Navy [Ref. 33:p. 11].

The AIM-7F SPARROW G&C assembly is made up of over 100 modules, with 5000 electronic parts, 20,000 solder joints, and 1,000 mechanical parts. The documentation on the G&C assembly has over 1200 drawings, 150 material and process specifications, and 120 critical item function specifications [Ref. 32:p. 6].

4. Rationale for Second Sourcing

The reasons for second sourcing the AIM-7F SPARROW missile should look familiar if one considers the decision variables and attributes discussed in Chapter III. First, the cost of the 7F version was projected at twice the cost of the 7E version. In an effort to reduce this cost, the use of competition was deemed appropriate. [Ref. 32:p. 7]

Second, the planned requirements for the Navy and the Air Force was for over 10,000 missiles over a production run of six to ten years. This production quantity and duration allowed for the recoupment of non-recurring costs due to the second sourcing program. Also, since the requirements were from both the Air Force and the Navy, industrial base concerns became an issue because of the desire for ensured production availability and expansion. Finally, the Government perception at this time was that the SPARROW missile had not improved over the years (in both performance parameters or operational availability) as quickly as desired. The lack of contractor/Government acquisition team incentive was cited as the reason. With the introduction of competition, the Government felt the cost of the missile would decrease, while the product's overall performance and reliability would increase. [Ref. 32:p. 7]

Why, then, was the TDP second sourcing methodology (or Government led D^3) used in this procurement? Interviewees claim that the desire to maintain configuration control, develop "in-house" talent to solve technology transfer questions and issues, and that the missile was using relatively mature technology, each contributed to the use of the TDP second sourcing methodology [Ref. 34]. Indeed, the desire to gain "in-house" expertise was cited as one of the most critical steps in this second sourcing effort [Ref. 32:p. 8]. Naval Weapons Center (NWC), China Lake, was designated as the center for validation of Raytheon's critical item functional specifications and was provided the requisite testing facilities to perform this function [Ref. 30:p. 8]. Other functions performed by NWC China Lake included technical cognizance and control of the data package, Government configuration management for the program's duration, primary control of engineering change proposals, functional and physical configuration audits, integrated logistics support, and product assurance/reliability program reviews [Ref. 32:p. 9].

5. Implementation of the Second Sourcing Program

The implementation of the AIM-7F SPARROW missile second sourcing program was performed in six basic steps [Ref. 32: p. 8]:

a. establish and maintain valid product baseline

b. bring documentation up to reprocurement data package quality

c. establish in-house technical cognizance organization with complete test facilities

d. screen industry for qualified contractors

e. provide five selected contractors with G&C unit and data package

f. evaluate proposals and award contract for first article

The first three steps have already been discussed. The fourth step is a classic example of market research in that the Government sought out interested companies to produce the AIM-7F SPARROW missile G&C assembly. Of the thirty one responses to the "sources sought" announcement in the Commerce Business Daily, five contractors were eventually selected to examine the G&C assembly and documentation. In that this fifth step spanned over a year, the review by five competent contractors of the G&C assembly and documentation proved highly beneficial to this second sourcing effort [Ref. 32:p. 8]. Also, due to testing and funds delays, the selectee, General Dynamics, Pamona Division (GD/P), was provided a planning contract for an additional year to ensure the progress made to that point would not be lost. This time was well spent. The data package of Raytheon was converted to GD/P production plans which facilitated the eventual contract award of first article and pilot production units. Appendix G gives a brief summary of the industry events [Ref. 32:p. 10].

6. Cost Effectiveness of the Second Sourcing Effort

This paper previously cited cost reduction as one of the effects of competition. The BDM study of the AIM-7F SPARROW missile stated that there was a savings of approximately

$30 million (about 4% of the total program cost) [Ref. 32: p. 14]. Appendix H provides a cost summary of sole sourcing versus second sourcing [Ref. 32:p. 14]. The breakeven point was approximately 7,000 G&C assemblies and that the cumulative cost summary was based on a 95% learning curve. Appendix I provides a graphical representation of this cost information [Ref. 32:p. 15]. The 95% learning curve reinforces the flat learning curve decision variable presented in the SSMSM Model.

Before applying this cost summary information in other missile programs, several points should be made to qualify this information as unique to the AIM-7F SPARROW missile program [Ref. 32:p. 15]. First, the design of the SPARROW missile had many technical problems. This delayed the data in which a second source could begin work on a baseline configuration. Second, the availability of an acceptable technical data package was slowed because not all of the components were pursued with second sourcing in mind. Third, lack of adequate data and lack of Government push is cited as causing the lengthy period of time (2 1/2 years) to select GD/P from the original list of responses in the Commerce Business Daily. Finally, the lack of funding caused a delay in getting a second source on-line and a reduction in program requirements that stretched out the breakeven point. [Ref. 30:p. 15]

Other studies have shown that the modest cost savings from second sourcing the SPARROW missile did not occur at all. Science Application, Inc., did a study in 1982 (SAI-82) and,

based on data at that time, the second sourcing of the G&C assembly cost an additional 31.4% [Ref. 10:p. 25]. In another study, the additional cost was estimated at 20.5% [Ref. 10: p. 36].

7. Problems and Issues of the Second Sourcing Effort

Cost was an issue in this program. More specifically, a reasonable payback on the $69 million up-front investment was expected. This investment consisted of $52 million for GD/P first article, production learning quantity, and tooling for 100 missiles per month capacity; $6 million for Raytheon to produce a technical data package; and, $11 million for NWC China Lake technical cognizance and configuration management effort. This second sourcing effort, however, was sold more on the basis of improved missile quality and mobilization base considerations than recoupment of investment dollars due to competition. [Ref. 32:p. 16]

Annual and total program costs were sensitive to the production rate and procurement quantities. Areas that influenced the procurement quantities and production rate were such things as annual budgeting, Air Force and Navy requirements, minimum sustaining rates for Raytheon and GD/P, and foreign military sales requirements [Ref. 32:p. 16]. As stated earlier, without stability of program funding, unit costs normally increase and there will be a program stretchout assuming the original program requirements are still needed. Other influences included long lead time material procurements, tooling and test equipment,

personnel training, and the distribution of fixed costs over quantities procured [Ref. 32:p. 16].

Another issue in this second sourcing effort was that of technology transfer. Regardless of the quality of the technical data package used for reprocurement, the second source will invariably experience some problems with the original developer's drawings [Ref. 32:p. 17]. This problem would fall under the issue of TDP validation.

Proprietary rights surfaced as an issue. The BDM study gave no specifics on this problem. It only stated that to effectively deal with proprietary claims, the Government must understand the contract and procurement regulations. Few claims will stand up to litigation if there is a complete and thorough development contract [Ref. 32:p. 17]. It is obvious from this discussion that good planning early in the acquisition process is needed in order to head off any future problems in the limited rights of data issue.

Intense Government involvement was the last issue brought out in the BDM study. The technical cognizance, configuration management, and product assurance oversight all combined to allow NWC China Lake and NAVAIR to deal with the two contractors, Raytheon and GD/P, as equals.

8. Lessons Learned

The real worth of the BDM study was to provide a section on lessons learned that would aid future program managers some insight on what to plan for or avoid in their programs.

The first lesson learned had to do with patience and time. There should be someone that will be able to stick with the program for five or more years. Just a small amount of corporate knowledge goes a long way in avoiding disrupting influences to the program. Also, patience is required, especially when one considers the myriad of technical and fiscal problems imposed on this second sourcing effort. It took nearly seven years to solicit a second source to the actual competition of the production units between Raytheon and GD/P [Ref. 32:p. 18].

This first lesson leads into a second; involve the second source as soon as possible and properly scope his effort. Even with the considerable effort by the Government to get a second source early in the program, seven years to create a qualified second source is considered excessive. Of that seven years, three to four years were caused by slowness on the Government's behalf, lack of an adequate technical data package, problems technologically with the AIM-7F SPARROW missile design, and fiscal constraints beyond the program manager's ability to control. [Ref. 32:p. 18]

Recognizing the importance and dynamic nature of the technical data package was another lesson learned. Product design baselining or "freeze" on configuration is nearly impossible for relatively complex systems. There are always subtle changes, especially after seven years, that will require a change to the technical data package. And if those changes

are not properly documented, then the Government, as the configuration control manager in a TDP second sourcing strategy, will be liable for the additional costs of the contractor's effort. [Ref. 32:p. 18]

To ensure a reasonable return on the up-front investment attendant to the second sourcing of a program, stable planned requirements is a necessity. Without stable program requirements, the effect on unit costs is usually unfavorable, exacerbated by the supporting of overhead and fixed costs of two or more producers. [Ref. 32:p. 18]

Attention to detail is mandatory when transferring technology using a technical data package. Literally hundreds of details and problems had to be resolved in order for FD/P to use the Raytheon TDP. [Ref. 32:p. 19]

The importance of configuration management was presented as a lesson learned in that to have uncontrolled change was to have uncontrolled cost. The issue of using block changes was raised. This is considered more efficient and cost effective than processing individual changes in accordance with MIL-STD 480. [Ref. 32:p. 19]

Another lesson learned is that there will always be some people that refuse to believe that second sourcing is a cost effective way to perform competition [Ref. 32:p. 19]. However, as discussed in Chapter II, production competition using second sourcing also may have the goals of increased industrial base, better product quality, and improved technology.

The final lesson learned had to do with another possible second sourcing methodology: leader-follower. The BDM study cited the fact that NAVAIR up to that time had used leader-follower one time in a major aircraft equipment item that eventually resulted in a law suit. Even though this technique had been used successfully in the Fleet Ballistic Missile guidance system, NAVAIR stated that leader-follower was not appropriate in the AIM-7F SPARROW missile program because NAVAIR did not want an existing deficient design transferred from one source to another [Ref. 32:p. 19]. The correction of this deficiency required direct Government involvement over an extended period of time. As noted by both the SSMSM Model and the F^3/D^3 Acquisition Decision Model, this direct involvement on behalf of the Government is not the intent of the leader-follower methodology.

9. Benefits of the Second Sourcing Program

The goals of this second sourcing effort had been to reduce program cost while improving the missile's quality and reliability and to expand the industrial base [Ref. 32: p. 21]. The reduction of program costs have had different determinations as stated in the above section on cost effectiveness. The quality and reliability did improve. In fact, the operational availability for the AIM-7F SPARROW missile had doubled from the objective set forth in the Decision Coordinating Paper [Ref. 32:p. 20]. The reason cited by most people involved with the program was due mainly to the design

improvements suggested by GD/P. The sole source has no real incentive to provide innovative solutions or improvements to his design. Expansion of the industrial base is an obvious benefit. With two producers, the Government gains the added capability of surge and mobilization.

As a last benefit cited in the BDM study, contracting becomes more simplified when using competition. Awards can be based on price competition alone whereas in sole source procurements, cost and pricing data, use of annual RFP's, and negotiation are required.

C. HIGH SPEED ANTI-RADIATION MISSILE COMMAND LAUNCH COMPUTER

1. Introduction

This presentation is based on program office interviews, interviews with a Naval Industrial Fund (NIF) activity, and review of the source selection plan. Interviews were provided by the contracting officer, TDP validation project engineer, and the NIF activity director resource and management.

2. Procurement History

Texas Instruments, Inc. (TI) is the sole source for the High Speed Anti-Radiation Missile (HARM) Avionics System. TI has developed and produced this system since 1974 in conjunction with their development of the AWG 88A HARM System. The HARM avionics system provides an interface between the missile and other aircraft avionics. Its purpose is to provide target identification, prioritization, display functions, and launch and mode parameters [Ref. 35:part 1, p. 1]. The avionics system,

specifically, the Command Launch Computer (CLC), CP 1001/AWG is currently produced in two versions. One version is to be installed on the Navy's A-7 while the other is to be installed on the Navy's A-6E and F/A 18 [Ref. 36].

Due to the cost growth of the avionics system, NAVAIR, in August 1981, requested Naval Avionics Center (NAC) to evaluate several acquisition alternatives. The goal was to establish a competitive environment for the HARM CLC at the lowest possible risk [Ref. 35:part 1, p. 1].

The acquisition alternative was to second source the HARM CLC. To that end, NAC began a TDP validation in September 1982 to serve as a product baseline for the solicitation [Ref. 35:part 1, p. 1]. They were also required to manufacture ten CLC's in 1983 to verify the TI data package [Ref. 35:p. 8].

NAVAIR AIR-05 was issued a Contracting Officer Warrant on 10 August 1983 which allowed them to act as Source Selection Authority (SSA). The SSA, on 23 March 1984, approved the Source Selection Plan authorizing NAC as the lead activity in evaluating the competitive proposals. [Ref. 35:p. 8]

The Request For Proposals (RFP) was issued on 17 May 1984. Of the twenty five solicitees, eight companies showed interest in the second sourcing of the HARM CLC. A pre-proposal conference was held at NAC on 26 June 1984 for those interested companies. Only one compnay, Lear Siegler, Inc., Astronics Division, Santa Monica, California (LSI) responded with a proposal by the 13 August 1984 due date. [Ref. 35:p. 8]

Based on the evaluation of this proposal by the Source Selection Evaluation Board (SSEB), the SSA directed that discussions and a site survey be accomplished with LSI, any technical data package changes be provided to LSI, and a Best and Final Offer (BFO) be solicited from LSI if the results of the site survey indicated that LSI's proposal could be made acceptable. [Ref. 35:p. 8]

The evaluation at LSI resulted in a negative pre-award decision based on quality assurance and production planning deficiencies and past production history. The Source Selection Evaluation Board (SSEB) still felt, however, that the LSI proposal could be made acceptable and recommended solicitation of the Best and Final Offer (BFO) to the Source Selection Authority. The SSA approved this recommendation. [Ref. 35: p. 8]

The award to LSO was made on 11 April 1985. This contract required the fabrication and qualification testing of six pre-production units. It also required priced production options for FY-85 (23 units) and FY-86 (31 units). [Ref. 37:p. 1]

3. HARM CLC and Documentation Characteristics

The HARM CLC is a highly complex item. It consists of over 100 integrated circuits, 12 layer/multi-layer printed boards, and an extremely fast processing speed (almost eight times that of an ordinary micro computer). [Ref. 36]

The documentation is Government owned. Also, the Government maintains possession of the documentation at NAC.

The Navy is the configuration manager of the technical data package (TDP) for the HARM CLC. [Ref. 36]

The TDP itself consists of approximately 250 drawings. These drawings are considered complex, containing over 2000 individual sheets. [Ref. 36]

The validation process, as stated earlier, was initiated in September 1982. Budgeted at $4.7 million, the effort not only provided for the validation of the TI TDP; but, also included the manufacture of nine employable units (down from the ten originally planned). All but one of these units was to be placed in inventory. The remaining unit was being considered for use by the second source for qualification purposes. A Method 4 validation (as explained in Chapter III) was performed by NAC, the most comprehensive of the five methods available (which results in the lowest risk of technology transfer). [Ref. 36]

4. Rationale for Second Sourcing

One reason for the HARM CLC second sourcing was the desire to control cost growth of the avionics system. NAVAIR felt that competition would lower the unit cost charged by TI. [Ref. 35:p. ii]

Improvement of the HARM CLC quality was also cited as a goal [Ref. 35:p. ii]. Although no specific problems were cited with the TI configuration, a complex item such as the HARM CLC could almost always be improved in both reliability and operational availability with another producer reviewing and

implementing the developer's data package. The second source almost always introduces new processes, materials, or technologies to allow the unit to perform at a higher state of readiness.

This discussion of quality and innovativeness in design brings out a side issue this researcher feels is important. Literature is replete with examples of the detriments of over specification [Ref. 38:pp. 38,40] and that design specifications are less conducive to innovation than the use of performance specifications. It is important to remember that even if a design specification, or TDP, is used as a second sourcing strategy, innovation is still possible as long as it is consistent with the level of maintenance philosophy (i.e., the innovation to the old design does not impact the repair of the item or the attendant life cycle cost considerations) [Ref. 29]. If the innovation to the unit's design interferes with the maintenance philosophy, that innovation could be considered in the realm of a performance specification conducive to the F^3 second sourcing strategy.

Another reason for the second sourcing of the HARM CLC was the number of items to be procured [Ref. 40]. A total of 788 HARM CLC's are planned to be purchased through the year 1992. Program duration is another consideration as can be seen by the number of years (six) the program will cover [Ref. 41:Enclosure 2:p. 4].

Mobilization base considerations was another reason for the second sourcing effort [Ref. 35:p. ii].

What was the rationale behind using the TDP or the Government-led D^3 second sourcing acquisition approach? NAC stated their rationale behind the Government-led D^3 acquisition approach was based on the fact that they had the technical expertise to validate a complex TDP such as the HARM CLC. Also, NAC's experience over the past several years has been that a contractor-led D^3 acquisition strategy (contractor teaming, leader-follower, and directed licensing) had a tendency to increase non-recurring costs. The reason cited was that the original producer would charge extraordinary fees for technology transfer in an effort to make up for the projected lost profits due to competition. NAC feels that they can validate a data package at a lower cost than the original producer's technology transfer fees. [Ref. 39]

NAVAIR stated that logistic costs had the biggest impact on this decision [Ref. 40]. Since so many of the HARM CLC's were to be purchased, and that they would be serviced in the fleet for the next twenty years, this would have a tremendous impact on life cycle costs [Ref. 40].

The issue of component recall from the fleet was presented as another reason for the TDP approach. It is extremely difficult to recall different configurations that a F^3 strategy will provide. There is the problem of properly identifying not only which units are in need of recall; but, also, where these units are deployed. Finally, the software for the test equipment was a standard item and extremely expensive. This precluded

the use of any other product design or acquisition strategy [Ref. 42].

5. Cost Effectiveness of the Second Sourcing Effort

Based on a calendar year 1983 payback analysis performed by NAVAIR, the total program savings due to the second sourcing of the HARM CLC was to be approximately $19 million [Ref. 41:p. 3]. This estimate was based upon the following assumptions [Ref. 41:p. 3]:

- the second source's first production unit costs would be about $150,000
- the learning curve is approximately 90-93% (notice not a steep learning curve)
- qualification costs of the second source would be about $2.5 million
- competition between TI and LSI would begin in FY-86

However, in 1985, these assumptions were changed. The justification of the proposed price in the source selection plan presented different unit price and qualification cost estimates. The NAC estimate for qualification costs had been revised downward to $1.7-2.0 million. LSI's original proposal estimated this to be approximately $2.0 million. In their Best and Final Offer (BFO), the proposed qualification cost was less than $1.3 million. [Ref. 35:p. 10]

The FY-85 production of 23 units had a unit price estimate from NAC at $67,000. The LSI original proposal had a unit price of about $55,000 and a BFO unit price of $51,000. [Ref. 35:p. 10]

The FY-86 production of 31 units had an even more favorable impact on unit prices. The NAC unit price estimate remained the same, $67,000. However, the LSI original proposal had a unit price estimate of just over $52,000 and a BFO of $47,000. [Ref. 35:p. 10]

The SSEB had concerns with reasonableness and completeness of the final offer by LSI. However, this cost realism issue was resolved during contract discussions (also, the proposed unit prices were not that far removed from the NAC estimates). Finally, the differences between the original proposal and the BFO were due to the capitalization of special tooling and test equipment. [Ref. 35:p. 10]

Another cost savings attributable to this second sourcing effort was a "no cost" failure free warranty. [Ref. 35:p. 10]

To put all of these numbers in perspective, TI's unit price for the HARM CLC, based on FY-84 contract prices on 40 units, was over $150,000 [Ref. 35:p. 10]. The per unit warranty cost was almost $12,000 [Ref. 37:p. 1].

Why were the NAC estimates reduced so dramatically from the 1983 projections? The best explanation for this is the possession of the TI TDP. NAC, during its validation process, can make much better estimates of the materials and labor required as well as the type of production and test equipment required [Ref. 39]. This reinforces the notion presented in the NAC acquisition model in that having in-house

expertise on a system or component provides for better contracting officer support and cost estimates [Ref. 20:pp. 2-3].

Why was there such a difference between the contract price of TI and LSI? The SSEB, of which NAC was a member, concluded that several factors may have influenced this difference [Ref. 35:pp. 10-11]. First, LSI may have been under the impression that there were other competitors still in the running for this contract. Second, there were differences in manufacturing methods between the two contractors. TI fabricates printed wiring boards and other components that make up a significant portion of the CLC cost. LSI is a parts integrator, subcontracting for all of the CLC parts. Third, testing is performed by TI where it is subcontracted by LSI. Therefore, TI charges off the maintenance costs of its test equipment. Finally, TI, as the sole source, may maintain an engineering staff dedicated to the CLC for configuration management. This would be segregated out in a competitive environment.

6. Issues and Lessons Learned

The validation effort of the TI technical data package took longer than originally estimated. Consequently, the product baseline was not established in advance of the solicitation. This caused some problems in the proposal process [Ref. 42]. The validation process took longer than NAC expected due mainly to parts availability. As it turned out, TI was the sole source producer on many of the parts that made up the CLC [Ref. 36]. The implications of this were that the cost of the parts are unfavorable, scheduling could be a problem,

new and unique test equipment and software may be used, and the validation process could be effected [Ref. 39]. Also, the lack of a product baseline may add to the technical risk of the contract proposal [Ref. 42].

A way to possibly break this sole source problem of the original producer on component parts would be to advertise the fact that a program is to be second sourced. Given enough advanced notice, industry may be able to seek out or create new sources as an alternative to the original producer. An example of this was the second sourcing of the Navy's AN-AYK 14 standard computer. [Ref. 39]

There were several issues cited by the program office as uncontrollable. These were the warranty clause on major weapon systems and components (Defense Authorization Act of 1984) and the more recent possible shift in Naval policy that it would no longer fund special tooling or test equipment [Ref. 42]. The warranty did impact the TI unit price by almost $12,000, as mentioned earlier. Fortunately, the special tooling and test equipment funding issue will not impact LSI's proposal due to their capitalization of these items.

Physical possession of the master data package is significant. This allows for better configuration control and aids in the validation process [Ref. 36]. Having masters of the data package also helps avoid some of the clarity and accuracy lessons learned problems (Chapter III).

When working with systems or components that contain printed wiring boards, arrangements should be made to procure

the production master artwork of the printed wiring boards. This picture of the board aids the validation process and it also is used to provide first generation copies to the second source. An alternative to this artwork would be to acquire magnetic tapes. The reason these are presented as a lesson learned is that this type of documentation is separate from the Level III technical data package and therefore overlooked. [Ref. 36]

Another lesson learned is to ensure that the original developer of a system or component does not reference his own internal standards or specifications. It is essential, for the smooth flow of the validation process and the transfer of technology, that military and/or industry standards and specifications are referenced in the data package of the original developer. This issue should be resolved in the development contract. [Ref. 36]

Other issues that should be resolved in the development contract are the purchase of the theory of operations document (provides the complete operational parameters of the component) and the purchase of hardware for use in the TDP validation process and for use by the second source in the qualification process. Therefore, not all items fabricated in the development phase should be consumed for destructive testing, inventory, or deployment. [Ref. 36]

Lastly, the dependence of physical configuration audits should be limited. These audits will usually indicate

that the contractor's items fall within the confines of his TDP, however, the reverse is not necessarily true. Therein lies the problem: the TDP does not necessarily mean that it can be used to result in an end item. [Ref. 36]

7. Benefits of the Second Sourcing Effort

The completion of a Method 4 validated TDP is a benefit of this second sourcing effort. It offers one of the lowest risks in technology transfer for the Government-led D^3 acquisition strategy. Also, this provides an easy means to reprocure the HARM CLC in future procurements.

Another benefit is the in-house expertise that is now provided by NAC. As stated earlier, this will help in cost estimation and negotiation of any proposed engineering changes.

Cost reduction is another benefit of this second sourcing effort. The 1983 payback analysis estimated a program savings of $19 million. Also, as of FY85, the unit price reduction, "no cost" failure free warranty, and lower than expected qualification costs are more examples of cost savings. Finally, the capitalization of the special tooling and test equipment saved the Navy additional money. Unfortunately, at the time of this writing, a more current payback analysis was not available to this researcher that incorporated these most recent cost changes.

Although no specifics were provided, there were quality improvements to the HARM CLC as a result of the NAC validation and the inspection of the TI TDP by the second source, LSI.

Finally, with the establishment of the new source, the industrial base will be improved at both the prime and subcontract levels. There have already been alternate sources of supply identified and used by the NAC validation team to break out those sole source parts made by TI. [Ref. 36]

D. SUMMARY

This chapter has presented several programs that have used the TDP second sourcing methodology. The intent of this chapter was to provide the reader with several cases of practical application to the theory presented in Chapter III. This was done as an attempt to give the reader an appreciation of the environment in which the major weapon systems acquisition process operates. Without this appreciation, the reader may repeat some of the problems that have already occurred in other programs. The next chapter is designed to be less descriptive in nature. Key issues generic to the TDP second sourcing methodology will be analyzed.

V. ANALYSIS OF TDP SECOND SOURCING METHODOLOGY ISSUES

A. INTRODUCTION

The research effort up to this point has been descriptive in nature. The background and framework were presented to give the reader an appreciation for the environment in which the major weapon systems acquisition process operates. The various second sourcing methodologies were presented, including two models for their application, and an overview of two programs that used the TDP second sourcing methodology. The intent of this chapter is to present key issues generic to the use of the TDP second sourcing methodology based upon the theory and practical application previously presented.

B. ANALYSIS OF KEY ISSUES

1. Technology Transfer

Technology transfer is a broad and key issue that the program manager must appreciate prior to the use of the TDP second sourcing methodology. Why? Primarily, since there is no contractor-to-contractor interface in this methodology, the Government is responsible for the TDP and the information therein. Consequently, the program manager, not the original developer, has to be sensitive to technology transfer issues such as complexity of the item, product baselining, and contractor qualification. If an item is extremely complex, the original developer may be the only one able to effectively

transfer the requisite technology to establish a second source. The program manager must decide whether or not to take on this responsibility or use the second sourcing methodologies such as leader-follower, directed licensing, or contractor teaming. In that the item is extremely complex, obtaining a baseline configuration for solicitation purposes may be difficult. The HARM command launch computer (CLC) had this particular problem. This had an influence on the amount of time that it took to obtain and qualify a second source. The SPARROW missile also had a problem establishing that baseline configuration. Therefore, to mitigate this problem, the program manager must allow enough time to establish a stable design in order to establish a second source in a timely manner. Finally, the technology transfer process may be affected by the ability of the second source to produce the item and the extent to which the second source will have to adapt his production facilities to the TDP. Interviews have suggested that the cost of rearranging the second source's facilities may be extremely expensive and seriously erode the effects of competition. A careful source selection process will help ensure the capability of the second source is up to the level required for the TDP.

2. Technical Data Package Validation

A closely related issue to technology transfer is TDP validation. The program manager should realize the importance of the validation process as a means to enhance the flow of technology transfer (stated conversely, TDP validation will

reduce the risk associated with technology transfer). What is the risk and how is it reduced? The risk is the ability of the second source to understand and produce to a TDP that is not his own. To reduce this risk, the program manager must validate the TDP to ensure its completeness, clarity, currency, accuracy, and adequacy. Also, the format of the TDP will be more generic in nature and free of contractor in-house referenced processes and parts. The use of industry and Government standards and specifications will be included in a properly validated data package.

The programs that were analyzed in Chapter IV developed several characteristics of the TDP validation process that should be presented here. The validation of the TDP can be very expensive depending on the method of validation used and the complexity of the item. Consequently, the program manager should ensure ample funding is available for this process. Also, as indicated in the HARM CLC, the validation process itself may run into difficulties. Sole source parts and proprietary processes are something that should be investigated prior to the validation process. Early planning can help avoid these contingencies. Otherwise, the implication for not starting the validation process early is the lack of a product baseline at the time of the solicitation.

3. Technical Data Rights

Another TDP second sourcing methodology issue that is also closely related to the technology transfer process is

technical data rights. This is an issue because without unlimited rights in data, the Government will not be able to effectively transfer the needed technology to a second source to allow for item replication. Internal or proprietary processes and/or parts may be referenced in the TDP. This was one of the lessons learned in the HARM CLC.

Another reason that data rights is an issue is the cost of purchasing the rights in data. First, the amount of private research and development funds expended by the original developer will have a significant impact on the cost of the data rights. The more the contractor spends on R&D, the more the Government can expect to pay for the acquisition of data rights. If the item has commercial applicability, the extent to which this applicability exists will have a direct bearing on the cost of the data rights. A company will be less willing to sell the data rights if that item can provide substantial commercial revenues. Finally, the program manager must consider the impact of obtaining the data rights relative to the size of the company. Conceivably, this item could be the company's only product. To purchase the data rights would, in essence, be to purchase the company.

To avoid or minimize the effects of the data rights issue, early planning is essential. The use of a data rights clause, the predetermination of data rights clause and the alternatives to the predetermination clause have been discussed in Chapter III. Early planning will facilitate their appropriate

use. Also, early planning will allow the Government to exercise its monopsonistic leverage. Competition in the early acquisition phases may effectively reduce or eliminate the data rights issue. Contractors may be more interested in contract award and therefore make concessions that would otherwise not be made in the sole source environment. Finally, the insertion of a "non-use" provision in the contract with the original developer will protect his interests while allowing for the transfer of the data rights to the second source. The "non-use" provision prohibits the second source in using the limited data for any purpose other than for the production of Government supplies.

If, for a mature program, the issue of data rights surface, how can its effects best be minimized? The program manager should first ensure that all data rights are identified in the data package. The contractor is then contacted to ensure the validity of the data rights. If the data rights are claimed to be valid, the contractor should be required to provide written substantiation for this claim. Given that the substantiation is adequate, the program manager should then attempt to negotiate for the option to purchase the data rights.

4. Initial Investment Costs

The issue of initial investment costs is generic to the TDP second sourcing methodology. Costs will be incurred for the TDP validation process, the purchase of unlimited rights in limited rights data, the purchase of the TDP itself, and the set-up costs for the second source. Therefore, the program

manager should plan for any additional funding to allow for these costs.

Several factors should be considered to reduce these costs. First, remember that there are several methods of TDP validation. As these methods become more comprehensive in scope, the cost associated with these methods increase. Therefore, the validation method should be chosen carefully to ensure unnecessary costs are not incurred. The cost of data rights can be reduced by early planning and the rigorous pursuit of the justification of these rights. As one reduces the scope and number of these data rights, the costs associated with purchase should decrease.

Competition is facilitated by the use of a properly validated TDP. Qualified contractors can compete on the basis of price. This streamlines the procurement process and allows for a reduction in administrative and production leadtime.

5. Maintenance Considerations

The maintenance philosophy is generic to all second sourcing methodologies. If the maintenance philosophy is organic in nature, then the reprocurement of identical items is appropriate. The costs associated with spares, repair parts, special test equipment, and personnel training, will increase due to the increase in the number of repairable items. If different configurations were procured and the maintenance philosophy was still organic, then the above costs would have to increase to support a unique item. However, if there was

no maintenance planned (as may be the case for items that are extremely reliable or consumable in nature) the importance of having an identical item is minimized or negated altogether.

To ensure that the proper second sourcing methodology is pursued, it is essential for the program manager to develop the maintenance philosophy early in the acquisition process. For example, if the maintenance is to be performed by the contractor or no maintenance is planned, then why bother securing the options to purchase data rights or the purchase of the TDP and its validation? This is clearly an unnecessary expense.

C. SUMMARY

This chapter has presented several key issues generic to the TDP second sourcing methodology, including; (1) technology transfer, (2) technical data package validation, (3) technical data rights, (4) initial investment costs, and (5) maintenance considerations. The program manager should consider these before the application of the TDP second sourcing methodology.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The focus of this research effort was to study the primary attributes or characteristics of the Technical Data Package second sourcing methodology and how this method could be successfully employed. Based on this study, the following conclusions are made.

1. The program manager must recognize when the Technical Data Package second sourcing methodology is particularly inappropriate for use.

The models presented in Chapter III and the analysis presented in Chapter V made it clear that there are circumstances where the TDP second sourcing methodology is particularly inappropriate. For instance, if the maintenance philosophy was not organic, then it may not be necessary to purchase the TDP. The models in Chapter III stated that if the item to be considered for second sourcing was consumable in nature or extremely reliable, then it would be appropriate to use other second sourcing methodologies, particularly, Form, Fit, and Function. Also, if there is a problem obtaining the data rights at reasonable cost, the TDP second sourcing methodology may not be appropriate.

2. When using the Technical Data Package as a vehicle for the transfer of technology to a production source, early planning is essential.

Issues such as TDP validation, rights in technical data, competition, and review of lessons learned should be resolved as early as possible to ensure the second sourcing effort will not be unnecessarily delayed. The earlier these issues are resolved, the faster the program can establish a second source.

3. There is no significant guidance for the application of the TDP second sourcing methodology.

The models described in Chapter III present various attributes or decision variables that aid the program manager in the selection of the proper second sourcing methodology. However, these models do not sufficiently examine the key issues that are generic to the TDP second sourcing methodology. This could give the program manager a false sense of security when applying the TDP second sourcing methodology.

4. The Second Sourcing Method Selection Model and the Form, Fit, and Function/Detailed Design Disclosure Acquisition Decision Model both present pertinent and relevant decision variables or attributes to use in second sourcing strategy decisions.

As discussed in Chapter III, both models provide the program manager with key decision variables or attributes that not only allow him to determine if his program is conducive to competition; but, also, which second sourcing methodology might be best for him to use. Factors such as procurement

quantity, duration of the program, and market research indicate if a program is conducive to competition. Other factors such as maintenance level philosophy, up front funding, and rights in technical data indicate whether a program is conducive to the TDP (or Government-led D^3) second sourcing acquisition strategy.

5. Program offices are aware of those factors that make a program conducive for competition and the TDP second sourcing methodology.

In each program analyzed in Chapter IV, factors such as maintenance level, procurement quality, program duration, and cost growth were all presented as reasons for the use of competition and the TDP second sourcing strategy.

6. The goals for competing both programs analyzed in this study have apparently been met using the TDP second sourcing methodology.

Each program office expressed a goal of cost control/reduction, quality and reliability improvement, and industrial base improvement. Except for the dispute on the cost effectiveness of the AIM-7F SPARROW missile guidance and control assembly, these goals have been achieved.

7. The Second Sourcing Method Selection Model fails to distinguish between those factors that are relevant for the competition and those that are relevant for second sourcing.

Duration of production and quantity produced are competition decision variables and should not be confused with second

sourcing decision variables such as item complexity or degree of private R&D. The SSMSM Model leads the user to believe that all of these variables should be considered to determine which second sourcing methodology is most appropriate when, in fact, some of these variables have a direct bearing on whether or not production competition is desirable at all, regardless of the second sourcing methodology chosen.

B. RECOMMENDATIONS

1. The F^3/D^3 Acquisition Decision Model should be employed under actual program conditions.

The F^3/D^3 Acquisition Decision Model is a very comprehensive model that allows the program manager to examine his program for competition and to determine which acquisition approach and strategy is best suited for the program. Future program managers should acquire this model from the Naval Avionics Center and use it in upcoming major weapon system acquisitions.

2. The F^3/D^3 Acquisition Decision Model should be expanded to include post-production programs.

The F^3/D^3 Acquisition Decision Model could be very valuable if its scope was extended to include more mature programs. The Naval Avionics Center should investigate ways to accomplish this expansion.

3. The program manager should perform a comprehensive TDP validation prior to its use as a second sourcing methodology.

The lack of a comprehensive TDP validation increases the risk of technology transfer. The program manager should use

Government or contractor resources to perform this validation process as a way to reduce this risk.

4. The Second Sourcing Method Selection Model should be amended to distinguish between competition and second sourcing methodology decision variables.

The SSMSM Model may confuse the user between competition and second sourcing decision variables. In that this model presents relevant variables to use in the competition and second sourcing decision process, the original authors should investigate ways to make this distinction.

C. ANSWERS TO RESEARCH QUESTIONS

1. What are the primary attributes or characteristics of the Technical Data Package (TDP) second sourcing methodology and how might this be successfully employed?

One attribute or characteristic of the TDP second sourcing methodology is that this method will result in a "Chinese copy" (or identical) item. This will usually prevent an increase of logistic support costs for such things as unique spares or repair parts, additional training, or new test equipment or software that would otherwise be caused if the item reprocured was not identical to the original.

The use of the TDP second sourcing methodology is greatly dependent on the level of maintenance philosophy. If the maintenance philosophy is organic, then the procurement of an identical item will control logistics costs. If a different

configuration of the item is procured, then logistics support costs will increase in order to maintain that item.

Reprocurement will be easier once a validated TDP is established. Also, the second source should not have to use additional research and development effort to use the TDP. This should reduce the cost of reprocurement since there will be no charge for this cost element. Finally, without this additional effort, the reprocurement should be quicker than that of the original procurement.

The Government is responsible for the quality of the TDP and is liable for any deficiencies contained therein. Consequently, the issue of technology transfer is an important consideration as well as TDP validation and data rights.

The transfer of technology is accomplished solely through a TDP and there is no contractor-to-contractor interface. Once again, the importance of TDP validation and data rights is presented. The program manager should be aware of these issues prior to the use of the TDP second sourcing methodology.

The TDP second sourcing methodology is best employed by planning early for its use, proper validation efforts, elimination or reduction of limited rights in data, and insuring proper up front funding for the validation and purchase of the TDP.

2. What is the Technical Data Package concept?

This concept is a method by which the Government is responsible for the technology transfer from one producer to another.

This is done by the use of the TDP. Also, there is no contractor-to-contractor interface for this technology transfer.

3. What have been the significant issues or problems involved with the TDP second sourcing methodology?

Technology transfer, TDP validation, data rights, initial investment costs, ease of reprocurement, and maintenance philosophy, are each significant issues that are attendant to the use of the TDP second sourcing methodology. Each of these issues must be examined in detail to ensure that the TDP second sourcing methodology is done on a timely and cost effective manner.

4. How does Technical Data Package relate to other second sourcing methodologies?

The TDP methodology is based on design specifications whereas the F^3 methodology is based on performance specifications. Both methods preclude the use of contractor-to-contractor interface. The technical data package transfers the technology to produce an identical item (at least to the level consistent with the maintenance philosophy). The F^3 requires only performance parameters be met regardless of the technology used to obtain them. The leader-follower, directed licensing, and contractor teaming methodologies require varying degrees of conctractor interfact to allow for a smooth flow of technology transfer. Design specifications are the basis for these methods in that identical items are being fabricated for reprocurement by the second source.

D. AREAS FOR FURTHER RESEARCH

One area for research should be the analysis of the NAC F^3/D^3 Acquisition Decision Model as applied to an actual program. Also, the incorporation of the key issues presented in Chapter V should be included in this model to give the program manager a better appreciation of these significant factors.

Another area for further research may be on the impact of computer-aided design/computer-aided manufacture (CAD/CAM) as it relates to the major weapon system acquisition phases of Concept Exploration, Demonstration and Validation, and Full Scale Development. Issues such as contract cost and type and the speed of these acquisition phases should be highlighted.

APPENDIX A

VALIDATION DECISION CHECKLIST

	Validation of the TDP is not Indicated	Validation of the TDP is Indicated
- One Time Build of Only a Few Units	X	
- Unique State of the Art Process Required and/or Proprietary Data are Essential to Systems Operation, and it has been determined that it is not cost effective to delete from data package or to procure rights to data	X (NOTE 1)	
- Urgent and Unforseen Requirements do not Allow Sufficient Time for Competition	X	
- The Design is not Stable	X	
- Large quantity, Multi-Year Procurements are Planned		X
- High Unit Costs and Inventory Value		X (NOTE 2)
- Validation Cost would be Offset by Savings Resulting from Competition		X
- Data Rights must/should be Owned by Government		X
- Broad Industrial Base is Available and/or Desired for Mobilization		X
- Contractor Failure Would Jeopardize Mission Requirements		X (NOTE 3)
- Long Term Support Needed (Spares)		X
- Large Production Capacities Required		X
- Systems/Equipment is Planned to be Multi-Platform Government Furnished Equipment		X

NOTES:

1. In a few select cases a product may have been developed which is "State-of-Art." It may be unwise to attempt competition and hence validation may not be essential.

A high program risk may occur and total program costs may be higher in the long run. A close watch must be maintained on this type of product to determine when industry acquires the design/process and establishes a wide base. Once this occurs, the data package should be validated and the product should then go competitive.

2. A low unit cost is not sufficient justification for sole source; other factors must be considered (i.e., quantities, industrial base, etc.).

3. If the failure of the sole source through natural catastrophy, business failure, labor difficulties, or inability to perform and deliver required systems hardware would jeopardize fleet mission requirements, competitive, or multiple acquisition sources with a properly validated data package should be planned and budgeted for.

APPENDIX B

COMPARISON OF COMPETITIVE ACQUISITION DATA VALIDATION METHODS

Method #1--Desk Top Audit (DTA)
Method #2--DTA and Configuration Audit Review (CAR)
Method #3--DTA/CAR and Real Time Audit of the Contractor with Selective Assembly/Test of Contractor Furnished Parts/Assemblies
Method #4--DTA and Manufacture a Lot Under Validation Conditions
Method #5--Combination of 3 & 4 above

	DATA VALIDATION METHOD (1)	DATA VALIDATION METHOD (2)	DATA VALIDATION METHOD (3)	DATA VALIDATION METHOD (4)	DATA VALIDATION METHOD (5)
1. Data Package and Design Benefits					
a. Assure that documentation exists for all component parts, subassemblies, and end items.	YES	YES	YES	YES	YES
b. Assure drawings in accordance with MIL-STD-100 and all material and finish specifications are latest revision.	YES	YES	YES	YES	YES
c. Assure DL represents desired configuration.	YES	YES	YES	YES	YES
d. Minimize major deficiencies in tolerances and dimensions.	NO	YES	YES	YES	YES
e. Minimize incompatibilities between part function and drawing specification.	NO	YES	YES	YES	YES
f. Assure raw material and purchased parts can be obtained competitively from commercial sources.	NO	NO	NO	YES	YES*

*For high risk elements validated by the complete process of method #4.

	DATA VALIDATION METHOD (1)	DATA VALIDATION METHOD (2)	DATA VALIDATION METHOD (3)	DATA VALIDATION METHOD (4)	DATA VALIDATION METHOD (5)
g. Assure specifications are adequate to inspect raw material and purchased parts.	NO	NO	NO	YES	YES
h. Eliminate high cost process where not warranted by part function.	NO	NO	YES	YES	YES
i. Assure sufficient information to produce and inspect all fabricated parts is specified by the data package.	NO	NO	NO	YES	YES*
j. Assure drawing specifications are achievable in volume production at reasonable yield levels using commercially available processes, tools, and equipment.	NO	NO	NO	YES	YES*
k. Identify, develop, and document mandatory processes.	NO	NO	NO	YES	YES*
l. Assure purchased and fabricated parts can be assembled into each succeeding "next assembly" up through final assembly.	NO	NO	YES	YES	YES
m. Assure subassemblies and final assembly meet specified physical dimensions.	NO	NO	YES	YES	YES
n. Assure subassemblies have adequate requirements (dimensional and functional) to assure that end-item functional requirements can be achieved at reasonable yields.	NO	NO	YES	YES	YES

*For high risk elements validated by the complete process of method #4.

	DATA VALIDATION METHOD (1)	DATA VALIDATION METHOD (2)	DATA VALIDATION METHOD (3)	DATA VALIDATION METHOD (4)	DATA VALIDATION METHOD (5)
o. Assure end-items produced to data package will meet required manufacturing acceptance tests.	NO	NO	YES	YES	YES
p. Assure end-item is mechanically and electrically compatible with aircraft, handling equipment, and test equipment interfaces.	NO	NO	YES	YES	YES
q. Assure end-item will function as required for specified service conditions.	NO	NO	YES	YES	YES

APPENDIX C

SECOND SOURCING METHOD SELECTION MODEL

SUMMARY OF DECISION VARIABLES AFFECTING SELECTION OF A SECOND SOURCING METHOD

Variable	Effect
Quantity of Production	Low quantities make second sourcing difficult, especially for technical data package.
Duration of Production	Qualifying a second source takes time. Licensing and leader-follower are particularly unsuitable.
Slope of Learning Curve	When steep learning is involved, any split of production quantities will tend to increase costs.
Technical Complexity	The more complex the system, the more difficult it is to second source. Contractor teaming is especially effective in bringing complementary technologies together.
State of the Art	Similar to technical complexity.
Other Government and Commercial Applications	If there are significant alternative uses for the system, original producer will probably create barriers to second sourcing.
Degree of Privately Funded Research and Development	Second sourcing success limited if critical elements are proprietary.
Special Tooling Costs	Provides original producer strong competitive advantage if costs are very high.
Cost of Transferring Unique Government-Owned Tooling	Equal weighting for all alternatives.
Capacity of the Developer/Original Producer	The more capacity the original producer has, the less likely second sourcing can be effective.
Maintenance Requirements	If second sourcing introduces variations in field maintenance, its viability decreases.
Production Lead Time	The longer the lead time, the smaller the advantages of second sourcing.

Variable	Effect
Degree of Subcontracting	If many subcontractors are involved, the advantages of second sourcing are diluted.
Contractual Complexity	The more complex the contractual relationship with the original producer, the more barriers there are to second sourcing.

SECOND SOURCING METHOD SELECTION MODEL: FIRST PRODUCTION

Variables	Methodology: Form-Fit-Function	Technical Data Package	Directed Licensing	Leader-Follower	Contractor Team
Quantity					
High	+	+	+	+	+
Medium	+	+	0	0	+
Low	0	0	-	-	0
Duration					
Long	+	+	+	+	+
Medium	+	+	0	+	+
Short	0	0	x	x	0
Learning Curve					
Steep	-	-	-	0	0
Flat	+	+	+	+	+
Technical Complexity					
High	0	x	+	+	*
Medium	+	-	+	+	+
Low	+	+	+	+	+
State of the Art					
Yes	0	x	+	+	*
No	+	+	+	+	+
Other Application					
Yes	+	0	+	0	+
No	+	+	+	+	+
Degree of Private R&D					
High	0	x	0	x	-
Low	+	0	+	+	+

Key:

+ = Strong applicability
- = Weak applicability
* = Particularly well suited
0 = Neutral applicability
x = Particularly inappropriate

Variables	Methodology				
	Form-Fit-Function	Technical Data Package	Directed Licensing	Leader-Follower	Contractor Team
Tooling Costs					
High	-	-	-	-	x
Low	+	+	+	+	+
Government Tool Transfer Cost					
High	0	0	0	0	0
Low	+	+	+	+	+
Contractor Capacity					
Excess	-	-	-	-	-
Deficient	+	+	+	+	+
Maintenance Requirement					
Significant	x	0	0	0	0
Minimal	+	+	+	+	+
Production Lead Time					
Long	-	-	-	-	-
Short	+	+	+	+	+
Degree of Subcontracting					
Heavy	0	-	-	-	-
Light	+	+	+	+	+
Contractor Complexity					
Complex	-	-	-	-	-
Simple	+	+	+	+	+

Key:

+ = Strong applicability
- = Weak applicability
0 = Neutral applicability
x = Particularly inappropriate

SECOND SOURCING METHOD SELECTION MODEL: REPROCUREMENT

Variables	Methodology				
	Form-Fit-Function	Technical Data Package	Directed Licensing	Leader-Follower	Contractor Team
Quantity					
High	+	+	+	+	+
Medium	+	0	0	0	+
Low	0	x	-	-	-
Duration					
Long	+	+	+	+	+
Medium	+	0	0	0	0
Short	0	x	x	x	-
Learning Curve					
Steep	0	0	0	0	0
Flat	+	+	+	+	+
Technical Complexity					
High	0	x	+	+	*
Medium	+	-	+	+	+
Low	+	+	+	+	+
State of the Art					
Yes	0	x	+	+	*
No	+	+	+	+	+
Other Application					
Yes	+	-	+	0	+
No	+	0	+	+	+
Degree of Private R&D					
High	0	x	0	x	0
Low	+	0	+	+	+

Key:

+ = Strong applicability
- = Weak applicability
* = Particularly well suited
0 = Neutral applicability
x = Particularly inappropriate

Variables	Methodology				
	Form-Fit-Function	Technical Data Package	Directed Licensing	Leader-Follower	Contractor Team
Tooling Costs					
High	-	-	-	-	x
Low	+	+	+	+	+
Government Tool Transfer Cost					
High	0	0	0	0	0
Low	+	+	+	+	+
Contractor Capacity					
Excess	-	-	-	-	-
Deficient	+	+	+	+	+
Maintenance Requirement					
Significant	x	0	0	0	0
Minimal	+	+	+	+	+
Production Lead Time					
Long	-	-	-	-	-
Short	+	+	+	+	+
Degree of Subcontracting					
Heavy	0	-	-	-	-
Light	+	+	+	+	+
Contractor Complexity					
Complex	-	-	-	-	-
Simple	+	+	+	+	+

Key:

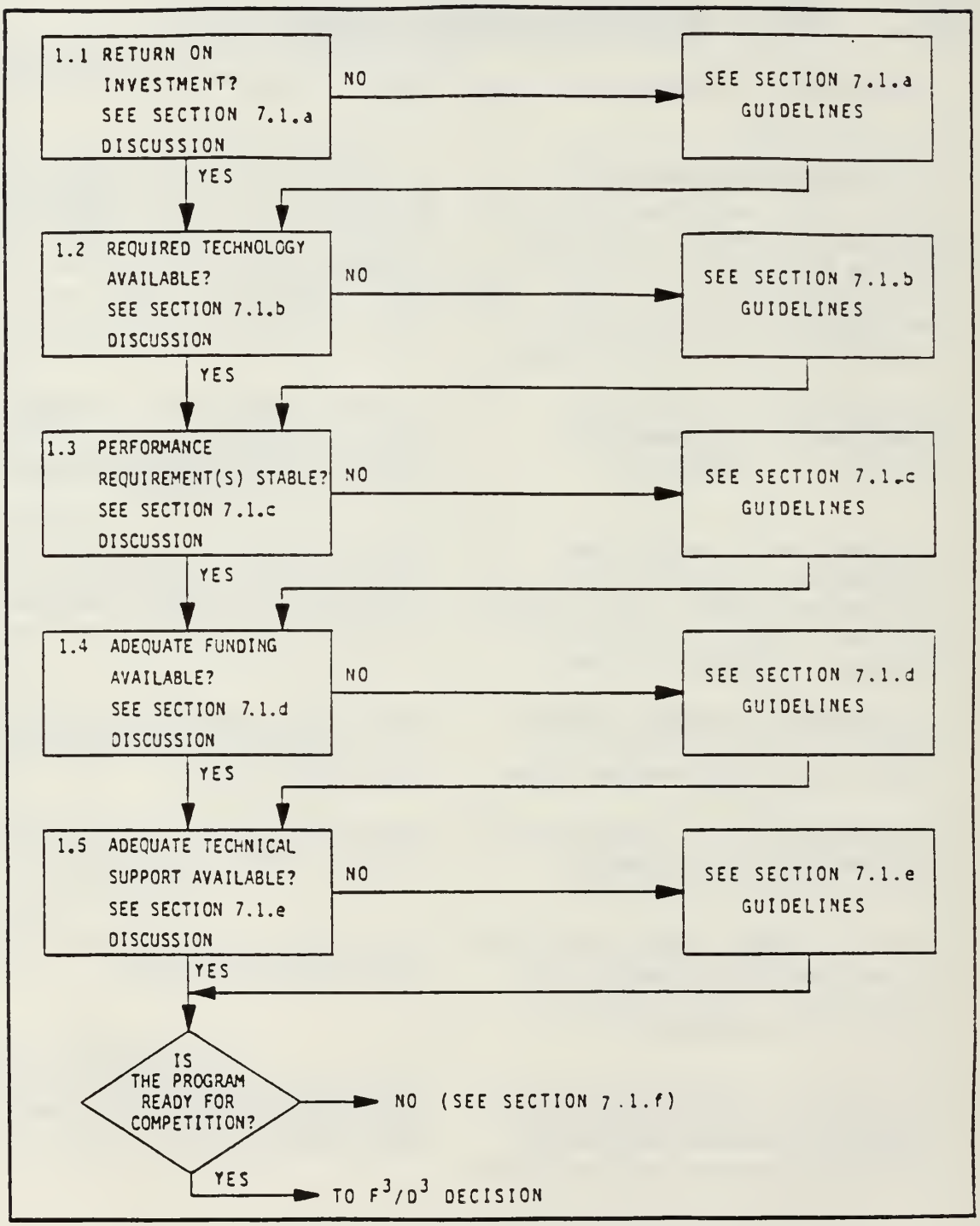
+ = Strong applicability
- = Weak applicability
0 = Neutral applicability
x = Particularly inappropriate

APPENDIX D

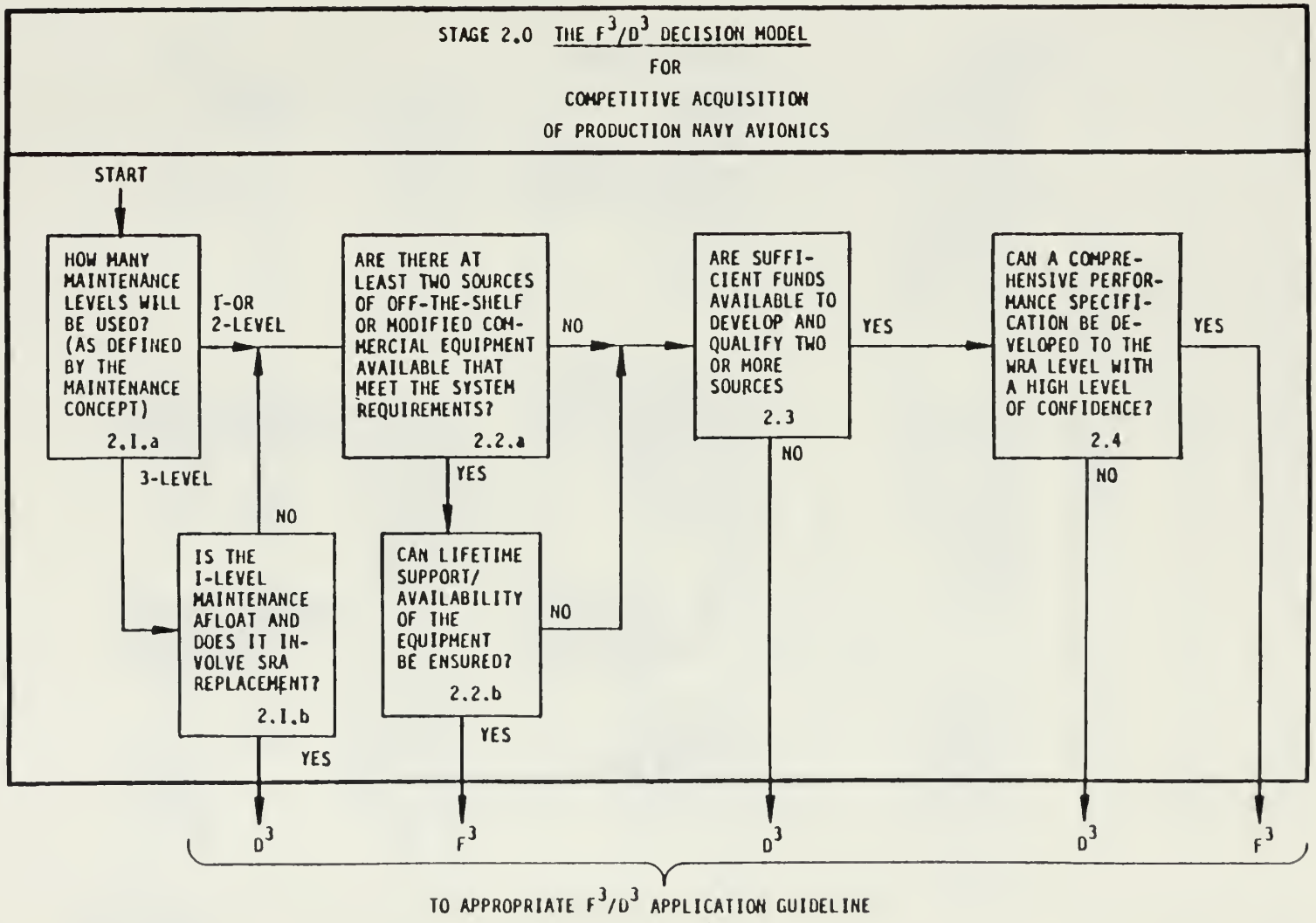
F^3/D^3 ACQUISITION DECISION MODEL

Comparative Summary of the F^3 and D^3 Acquisition Approaches

F^3 Acquisition Approach	D^3 Acquisition Approach
Form, Fit, and Function only ensures interchangeability at the WRA level. Internal configurations may vary. WRAs are functionally but not logistically interchangeable.	D^3 ensures interchangeability at the WRA, SRA, and piece part levels. Internal configurations are identical. WRAs and SRAs are functionally and logistically interchangeable.
Development of multiple suppliers' equipment in parallel is required.	Design competition between competing FSD contractors is encouraged but single source development of equipment is permissible.
If compliance with the system/WRA specification can be demonstrated, the contractor is authorized to make internal design changes.	The contractor must obtain Navy approval for all design changes. Government retains configuration control during full production.
Contractor assumes responsibility for adequacy of design and production data.	Government assumes responsibility for adequacy of design and production data.
Government buys maintenance data only when organic maintenance is planned.	Government buys the Technical Data Package (TDP) and the data rights.
The equipment specification is validated through the contractor and Government test and evaluation.	The TDP is validated by an independent source.
Production competition is achieved through continuing competition between/among the development contractors.	Competitive production sources are established using the validated TDP.



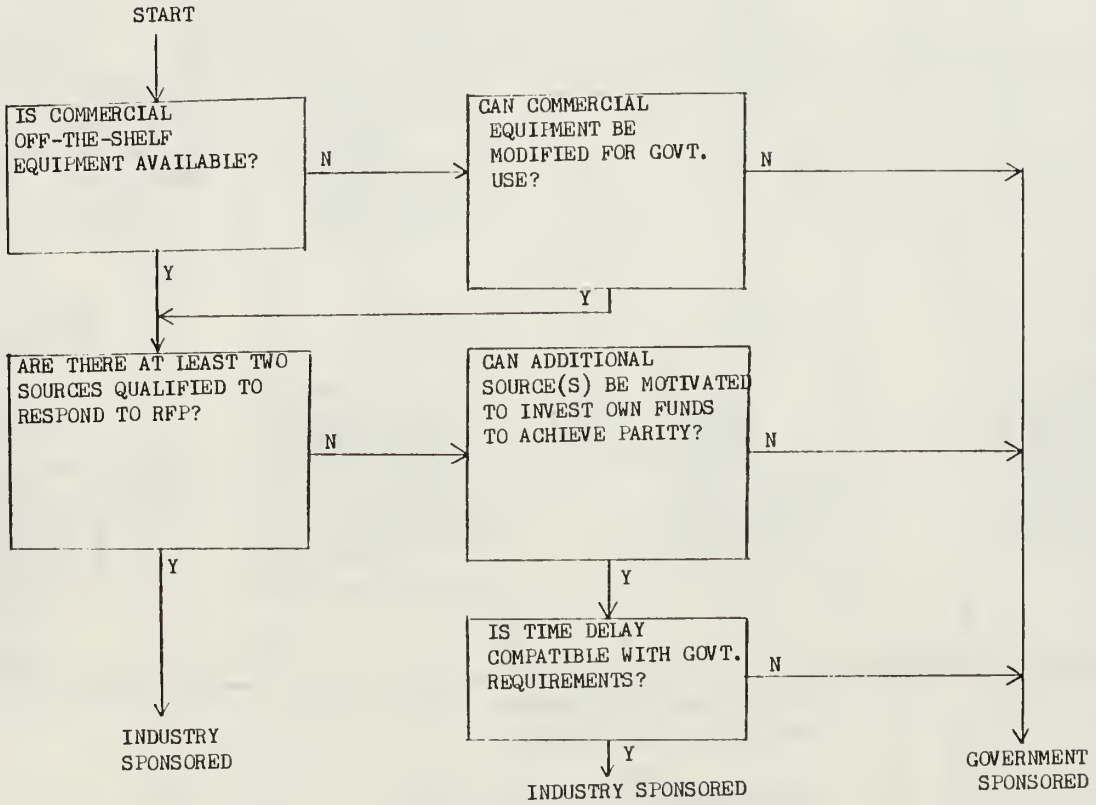
COMPETITION/PRODUCTION CONSIDERATIONS (STAGE 1.0)



THE F^3/D^3 DECISION MODEL

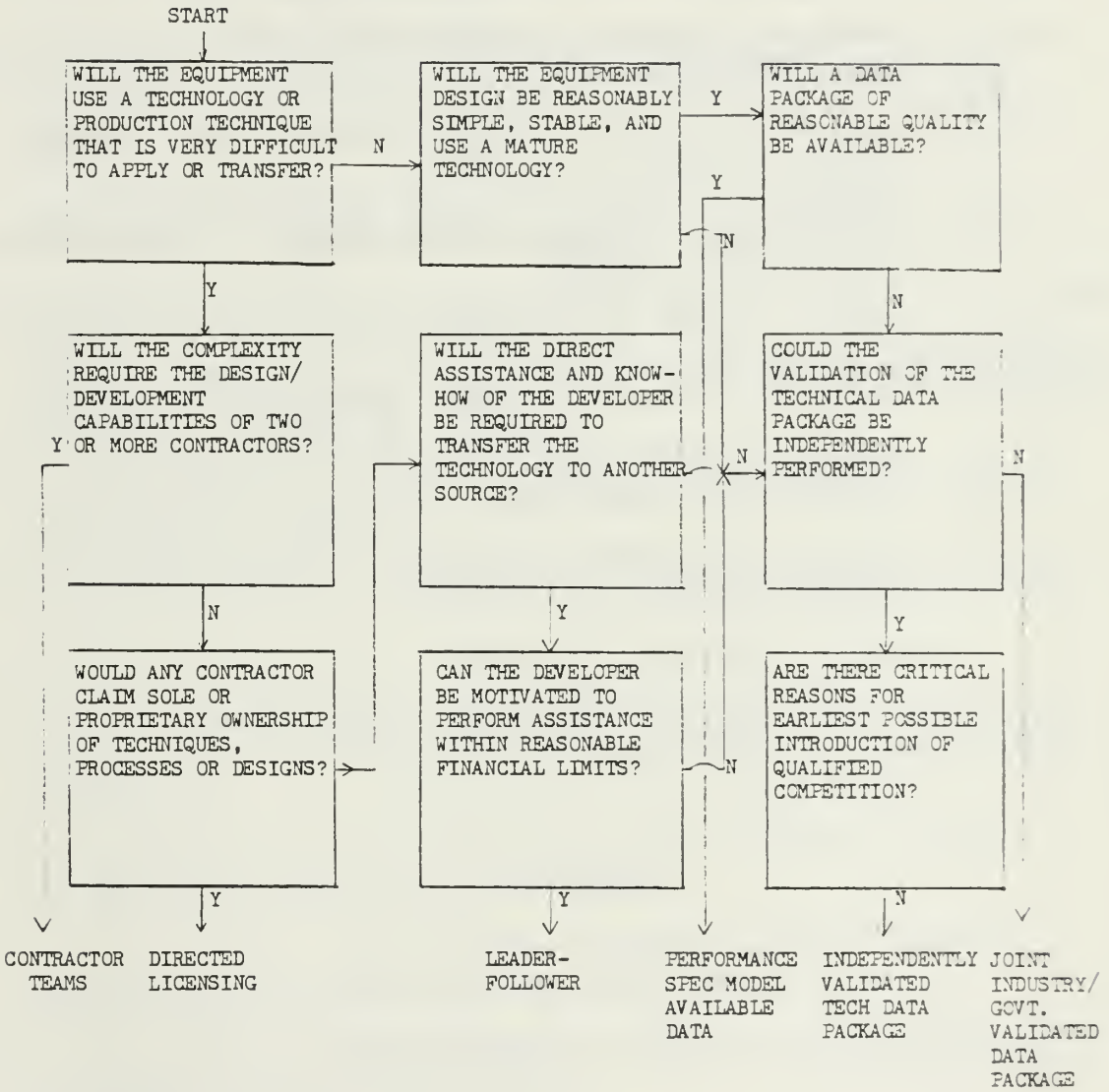
STAGE 3

F^3 COMPETITIVE ACQUISITION STRATEGY
DECISION MODEL



STAGE 3

D^3 COMPETITIVE ACQUISITION STRATEGY DECISION MODEL


START
WILL THE EQUIPMENT USE A TECHNOLOGY OR PRODUCTION TECHNIQUE THAT IS VERY DIFFICULT TO APPLY OR TRANSFER?
N
WILL THE EQUIPMENT DESIGN BE REASONABLY SIMPLE, STABLE, AND USE A MATURE TECHNOLOGY?
Y
WILL A DATA PACKAGE OF REASONABLE QUALITY BE AVAILABLE?
Y
N
Y
N
WILL THE COMPLEXITY REQUIRE THE DESIGN/ DEVELOPMENT CAPABILITIES OF TWO OR MORE CONTRACTORS?
WILL THE DIRECT ASSISTANCE AND KNOW-HOW OF THE DEVELOPER BE REQUIRED TO TRANSFER THE TECHNOLOGY TO ANOTHER SOURCE?
COULD THE VALIDATION OF THE TECHNICAL DATA PACKAGE BE INDEPENDENTLY PERFORMED?
Y
N
N
N
Y
Y
WOULD ANY CONTRACTOR CLAIM SOLE OR PROPRIETARY OWNERSHIP OF TECHNIQUES, PROCESSES OR DESIGNS?
CAN THE DEVELOPER BE MOTIVATED TO PERFORM ASSISTANCE WITHIN REASONABLE FINANCIAL LIMITS?
ARE THERE CRITICAL REASONS FOR EARLIEST POSSIBLE INTRODUCTION OF QUALIFIED COMPETITION?
N
Y
Y
Y
N
CONTRACTOR TEAMS
DIRECTED LICENSING
LEADER-FOLLOWER
PERFORMANCE SPEC MODEL AVAILABLE DATA
INDEPENDENTLY VALIDATED TECH DATA PACKAGE
JOINT INDUSTRY/ GOVT. VALIDATED DATA PACKAGE

6.3.1 INFORM ALL POTENTIAL CONTRACTORS OF PLANS FOR PRODUCTION COMPETITION.

6.3.2 BUDGET SUFFICIENT FUNDS TO OBTAIN MORE THAN ONE QUALIFIED DESIGN/PRODUCER.

6.3.3 PREPARE A COMPLETE AND ACCURATE PERFORMANCE SPECIFICATION FOR EACH WRA IN THE SYSTEM.

6.3.4 RETAIN OPTION TO PURCHASE DATA/DATA RIGHTS IN ALL FSD AND PRODUCTION RFP'S.

6.3.5 INCLUDE DATA/DATA RIGHTS OPTION (NOT-TO-EXCEED) IN SOURCE SELECTION CRITERIA.

6.3.6 PURCHASE MAINTENANCE ITEMS NEEDED TO SUPPORT PLANNED MAINTENANCE CONCEPT.

6.3.7 RETAIN OPTION TO PURCHASE ALL OTHER MAINTENANCE ITEMS.

6.3.8 PURCHASE DATA FOR A PARTS TRACEABILITY PROGRAM.

6.3.9 INCLUDE CLAUSE IN ALL CONTRACTS GUARANTEEING LIFETIME SUPPORTABILITY/AVAILABILITY.

6.3.10 DEVELOP FALL-BACK STRATEGIES IN THE EVENT F^3 PROGRAM REVERTS TO ONE CONTRACTOR.

6.4.1 INFORM ALL POTENTIAL CONTRACTORS OF PLANS FOR PRODUCTION COMPETITION.

6.4.2 BUDGET SUFFICIENT FUNDS TO DEVELOP AND FACILITIZE TWO OR MORE PRODUCERS.

6.4.3 PREPARE A COMPLETE AND ACCURATE PERFORMANCE SPECIFICATION TO THE SYSTEM LEVEL.

6.4.4 STRUCTURE THE FSD RFP AND ESTABLISH SOURCE SELECTION CRITERIA TO GUARANTEE THAT BOTH CONTRACTORS OF THE SELECTED TEAM WILL EVENTUALLY BE CAPABLE OF INDEPENDENT PRODUCTION.

6.4.5 SEEK LEGAL COUNSEL BEFORE PLACING FSD CONTRACTS TO DETERMINE IF ANTITRUST PROBLEMS MIGHT EXIST.

6.4.6 PROHIBIT THE USE OF PROPRIETARY AND/OR SOLE SOURCE PARTS.

6.4.7 RETAIN THE OPTION TO PURCHASE THE TECHNICAL DATA PACKAGE AND DATA RIGHTS AND INCLUDE THIS OPTION (NOT-TO-EXCEED) IN SOURCE SELECTION CRITERIA.

6.4.8 PURCHASE MAINTENANCE ITEMS NEEDED TO SUPPORT PLANNED MAINTENANCE CONCEPT.

6.4.9 RETAIN OPTION TO PURCHASE ALL OTHER MAINTENANCE ITEMS.

6.4.10 PURCHASE DATA FOR A PARTS TRACEABILITY PROGRAM.

6.4.11 DO NOT ALLOW EITHER CONTRACTOR TO ENTER THE PRODUCTION PHASE UNTIL BOTH SOURCES ARE QUALIFIED (TECHEVAL AND OPEVAL).

6.4.12 IMPLEMENT PARALLEL PILOT PRODUCTION BEFORE PLACING COMPETITIVE PRODUCTION CONTRACTS.

6.4.13 IMPOSE STRICT CONFIGURATION CONTROL ON THE PRODUCT BASELINE DURING THE FSD AND PRODUCTION PHASES.

6.4.14 IMPOSE STRICT REQUIREMENTS ON USE OF NON-STANDARD TEST EQUIPMENT AND/OR PROCEDURES.

6.5.1 INFORM ALL POTENTIAL CONTRACTORS OF PLANS FOR PRODUCTION COMPETITION.

6.5.2 BUDGET SUFFICIENT FUNDS TO IMPLEMENT COMPETITION.

6.5.3 PERFORM A COMPLETE AND ACCURATE PERFORMANCE SPECIFICATION TO THE SYSTEM LEVEL.

6.5.4 SEEK LEGAL COUNSEL BEFORE PLACING FSD CONTRACT TO FULLY UNDERSTAND LEGAL CLAIMS OF DEVELOPER.

6.5.5 DEVELOP CRITERIA FOR THE MANDATING OF DIRECTED LICENSING.

6.5.6 PROHIBIT THE USE OF PROPRIETARY AND/OR SOLE SOURCE PARTS TO THE MAXIMUM EXTENT PRACTICABLE.

6.5.7 RETAIN THE OPTION TO PURCHASE THE TECHNICAL DATA PACKAGE AND DATA RIGHTS (NOT-TO-EXCEED) AND INCLUDE THIS OPTION IN SOURCE SELECTION CRITERIA.

6.5.8 PURCHASE MAINTENANCE ITEMS NEEDED TO PERFORM PLANNED MAINTENANCE CONCEPT.

6.5.9 RETAIN OPTION TO PURCHASE ALL OTHER MAINTENANCE ITEMS.

6.5.10 PROCURE DATA FOR A PARTS TRACEABILITY PROGRAM.

6.5.11 IMPOSE STRICT CONFIGURATION CONTROL ON THE PRODUCT BASELINE DURING THE PRODUCTION PHASE.

6.5.12 IMPOSE STRICT REQUIREMENTS ON USE OF NON-STANDARD TEST EQUIPMENT AND/OR PROCEDURES.

6.6.1 INFORM ALL POTENTIAL CONTRACTORS OF PLANS FOR PRODUCTION COMPETITION.

6.6.2 BUDGET SUFFICIENT FUNDS TO MOTIVATE LEADER AND DEVELOP FOLLOWER.

6.6.3 PREPARE A COMPLETE AND ACCURATE PERFORMANCE SPECIFICATION TO THE SYSTEM LEVEL.

6.6.4 DEVELOP CRITERIA FOR THE SELECTION OF THE FOLLOWER SOURCE AS PART OF FSD CONTRACT.

6.6.5 DEVELOP CONTRACT INCENTIVES TO ENCOURAGE THE LEADER TO ASSIST IN THE TRANSFER OF TECHNOLOGY AND PRODUCTION CAPABILITY TO THE FOLLOWER.

6.6.6 PROHIBIT THE USE OF PROPRIETARY AND/OR SOLE SOURCE PARTS.

6.6.7 RETAIN OPTION TO PURCHASE THE TECHNICAL DATA PACKAGE AND DATA RIGHTS (NOT-TO-EXCEED) AND INCLUDE IN SOURCE SELECTION CRITERIA.

6.6.8 PURCHASE MAINTENANCE ITEMS NEEDED TO SUPPORT PLANNED MAINTENANCE CONCEPT.

6.6.9 RETAIN OPTION TO PURCHASE ALL OTHER MAINTENANCE ITEMS.

6.6.10 PURCHASE DATA FOR A PARTS TRACEABILITY PROGRAM.

6.6.11 IMPOSE STRICT CONFIGURATION CONTROL ON THE PRODUCT BASELINE DURING THE PRODUCTION PHASE.

6.6.12 IMPOSE STRICT REQUIREMENTS ON USE OF NON-STANDARD TEST EQUIPMENT AND/OR PROCEDURES.

6.7.1 INFORM ALL POTENTIAL CONTRACTORS OF PLANS FOR PRODUCTION COMPETITION.

6.7.2 BUDGET SUFFICIENT FUNDS TO IMPLEMENT PRODUCTION COMPETITION.

6.7.3 PREPARE A COMPLETE AND ACCURATE PERFORMANCE SPECIFICATION TO THE SYSTEM LEVEL.

6.7.4 DEVELOP SOURCE SELECTION CRITERIA TO ENSURE THE SELECTION OF A COMPETITIVE SOURCE THAT HAS SUFFICIENT CAPABILITY TO PERFORM REVERSE ENGINEERING AND EFFICIENT MANUFACTURING.

6.7.5 PROHIBIT THE USE OF PROPRIETARY AND/OR SOLE SOURCE PARTS.

6.7.6 PURCHASE THE TECHNICAL DATA PACKAGE AND DATA RIGHTS IN FSD CONTRACT.

6.7.7 PURCHASE MAINTENANCE ITEMS NEEDED TO SUPPORT PLANNED MAINTENANCE CONCEPT.

6.7.8 RETAIN OPTION TO PURCHASE ALL OTHER MAINTENANCE ITEMS.

6.7.9 PURCHASE DATA FOR A PARTS TRACEABILITY PROGRAM.

6.7.10 IMPOSE STRICT CONFIGURATION CONTROL ON TECHNICAL DATA PACKAGE AND THE PRODUCT BASELINE DURING PRODUCTION PHASE.

6.7.11 PERFORM A DESK-TOP AUDIT OF THE TECHNICAL DATA PACKAGE BEFORE USING IT AS A BASIS FOR CONTRACTURAL REQUIREMENTS LEVIED ON COMPETITIVE SOURCE.

6.7.12 IMPOSE STRICT REQUIREMENTS ON USE OF NON-STANDARD TEST EQUIPMENT AND/OR PROCEDURES.

6.8.1 INFORM ALL POTENTIAL CONTRACTORS OF PLANS FOR PRODUCTION COMPETITION.

6.8.2 BUDGET SUFFICIENT FUNDS TO IMPLEMENT PRODUCTION COMPETITION.

6.8.3 PREPARE A COMPLETE AND ACCURATE PERFORMANCE SPECIFICATION TO THE SYSTEM LEVEL.

6.8.4 PROHIBIT THE USE OF PROPRIETARY AND/OR SOLE SOURCE PARTS.

6.8.5 PURCHASE THE TECHNICAL DATA PACKAGE AND DATA RIGHTS AND INCLUDE IN SOURCE SELECTION CRITERIA.

6.8.6 PURCHASE ANY SPECIAL TOOLING AND TEST EQUIPMENT NEEDED TO VALIDATE THE DATA PACKAGE AND TO ESTABLISH THE PRODUCTION CAPABILITY AT THE COMPETITIVE SOURCE. INCLUDE IN SOURCE SELECTION CRITERIA.

6.8.7 PURCHASE MAINTENANCE ITEMS NEEDED TO SUPPORT PLANNED MAINTENANCE CONCEPT.

6.8.8 RETAIN OPTION TO PURCHASE ALL OTHER MAINTENANCE ITEMS.

6.8.9 PURCHASE DATA FOR A PARTS TRACEABILITY PROGRAM.

6.8.10 CONTRACT WITH THE DEVELOPING SOURCE FOR TECHNICAL ASSISTANCE DURING DATA PACKAGE VALIDATION TO RESOLVE DISCREPANCIES IN THE DATA AND MANUFACTURING PROCESSES.

6.8.11 IMPOSE STRICT CONFIGURATION CONTROL ON TECHNICAL DATA PACKAGE.

6.8.12 VALIDATE THE TECHNICAL DATA PACKAGE BEFORE USING IT TO ESTABLISH A COMPETITIVE SOURCE.

6.8.13 IMPOSE STRICT REQUIREMENTS ON USE OF NON-STANDARD TEST EQUIPMENT AND/OR PROCEDURES.

6.9.1 INFORM POTENTIAL CONTRACTORS OF PLANS FOR PRODUCTION COMPETITION.

6.9.2 BUDGET SUFFICIENT FUNDS TO IMPLEMENT PRODUCTION COMPETITION.

6.9.3 PREPARE A COMPLETE AND ACCURATE PERFORMANCE SPECIFICATION TO THE SYSTEM LEVEL.

6.9.4 PROHIBIT THE USE OF PROPRIETARY AND/OR SOLE SOURCE PARTS.

6.9.5 PURCHASE THE TECHNICAL DATA PACKAGE AND DATA RIGHTS AND INCLUDE IN SOURCE SELECTION CRITERIA.

6.9.6 PURCHASE ANY SPECIAL TOOLING AND TEST EQUIPMENT NEEDED TO VALIDATE THE DATA PACKAGE AND TO ESTABLISH THE PRODUCTION CAPABILITY AT THE COMPETITIVE SOURCE. INCLUDE IN SOURCE SELECTION CRITERIA.

6.9.7 PURCHASE MAINTENANCE ITEMS NEEDED TO SUPPORT PLANNED MAINTENANCE PHILOSOPHY.

6.9.8 RETAIN OPTION TO PURCHASE ALL OTHER MAINTENANCE ITEMS.

6.9.9 PURCHASE DATA FOR A PARTS TRACEABILITY PROGRAM.

6.9.10 CONTRACT WITH THE DEVELOPING SOURCE FOR TECHNICAL ASSISTANCE DURING DATA PACKAGE VALIDATION TO RESOLVE DISCREPANCIES IN THE DATA AND MANUFACTURING PROCESSES.

6.9.11 IMPOSE STRICT CONFIGURATION CONTROL ON TECHNICAL DATA PACKAGE.

6.9.12 DEVELOP AN INTEGRATED PLAN FOR THE JOINT VALIDATION EFFORT THAT DESCRIBES THE TASKS TO BE PERFORMED AND THE SCHEDULE/PHASING OF THE TASKS FOR THE GOVERNMENT, THE DEVELOPER AND THE COMPETITIVE SOURCE.

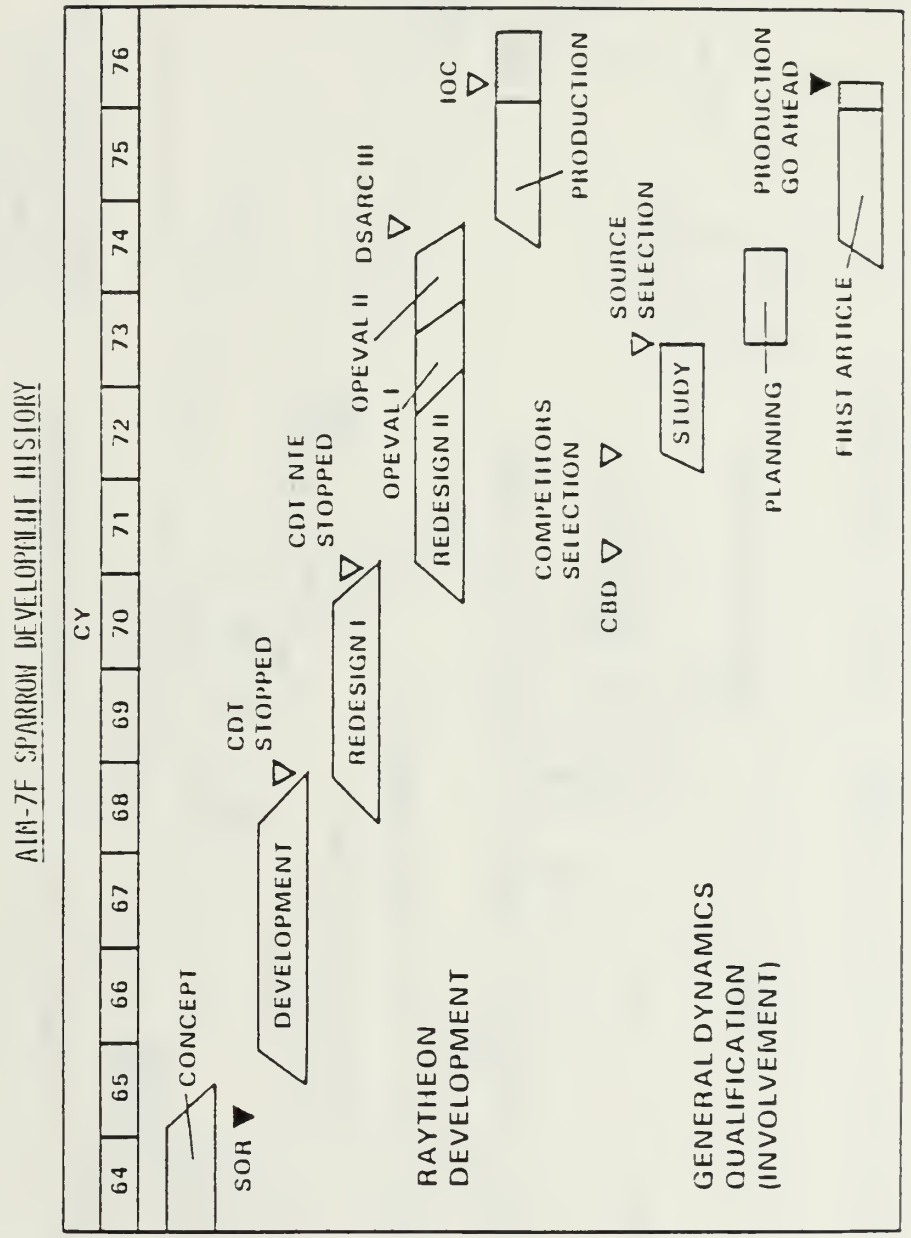
6.9.13 ESTABLISH SOURCE SELECTION CRITERIA TO ENSURE THE SELECTION OF A COMPETITIVE SOURCE THAT HAS SUFFICIENT ENGINEERING AND MANUFACTURING CAPABILITY TO VALIDATE THE DATA PACKAGE AS DEFINED IN THE PLAN.

6.9.14 VALIDATE THE DATA PACKAGE BEFORE ESTABLISHING PRODUCTION COMPETITION.

6.9.15 IMPOSE STRICT REQUIREMENTS ON USE OF NON-STANDARD TEST EQUIPMENT AND/OR PROCEDURES.

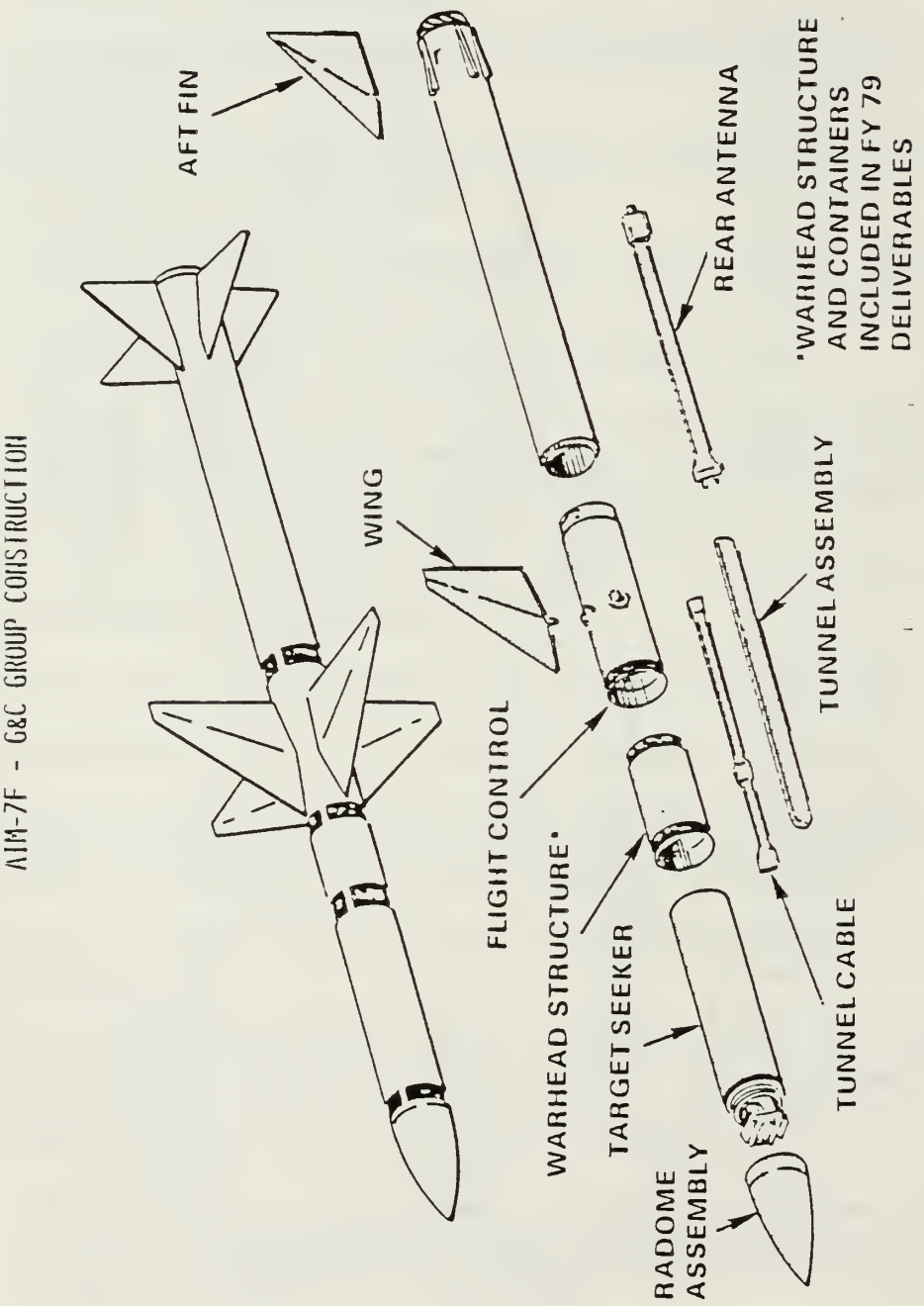
APPENDIX E

AIM-7F SPARROW DEVELOPMENT HISTORY



APPENDIX F

AIM-7F--G&C GROUP CONSTRUCTION



APPENDIX G

AIM-7F SECOND SOURCE IMPLEMENTATION--
INDUSTRY KEY EVENTS

MAR 71 - SOLICIT EXPRESSIONS OF INTEREST - 31 RESPONSES

NOV 71 - REQUEST SOURCE QUAL INFORMATION - 13 RESPONSES

JUN 72 - SELECT 5 CONTRS; PROVIDE G&C AND DATA FOR STUDY

DEC 72 - ISSUE RFP

FEB 73 - RECEIVE PROPOSALS

MAY 73 - RECEIVE BEST AND FINAL OFFERS

JUL 73 - SELECT GD/POMONA; AWARD $1.2M FOR PLANNING

JUL 74 - AWARD GD/P CONTRACT FOR 15 FIRST ARTICLES

SEP 75 - AWARD GD/P CONTRACT FOR 70 PILOT PRODUCTION

JUN 76 - QUALIFY GD/P FIRST ARTICLE

JUN 77 - DELIVER FIRST PRODUCTION G&C FROM SECOND SOURCE

APPENDIX H

AIM-7F DUAL VS SOLE-SOURCE COST SUMMARY FY73-80

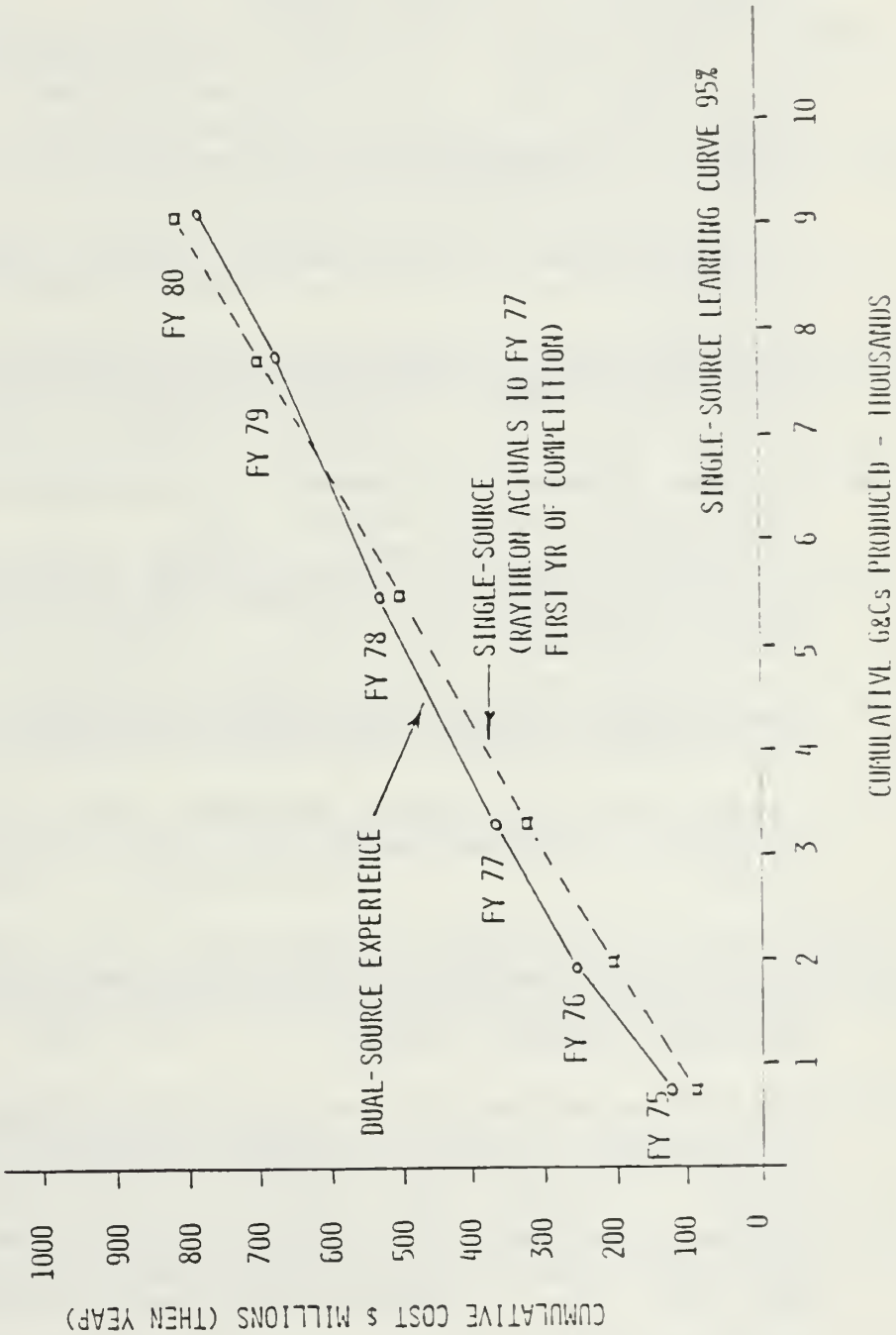
AIM-7F DUAL VS SOLE-SOURCE COST SUMMARY FY 73 - 80
(THEN-YEAR $)

	DUAL SOURCE		SOLE SOURCE
	GD	RAYTHEON	RAYTHEON
• MISSILE G&Cs[1/]			
QTY	2,865	6,205	9,070
COST	$259.5M	$470.4M	$785.4M
• TOOLING	$ 22.4M	$ 11.0M	$ 20.4M
	$281.9M	$481.4M	
	$763.3M		$805.8M
• RMC COST FOR 2ND SOURCE	$ 11.0M		-0-
TOTAL COST FY 73-80	$774.3M		$805.8M

1/G&C ACCOUNTS FOR ABOUT 88% OF ALL-UP-ROUND COST

APPENDIX I

AIM-7F DUAL VS SOLE-SOURCE--CUMULATIVE COST SUMMARY



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